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ECONOMIC AFFAIRS

No. 914



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CONTENTS	PAGE
Gosplan Official Discusses Current Economic Goals (Vasiliy Yakovlevich Isayev Interview; NEDELYA, 31 Dec 79 - 6 Jan 80).....	1
Impact of Scientific-Technical Progress on the Effectiveness of Production (Ya. Ryabov; PLANOVOYE KHOZYAYSTVO, Dec 79).....	8
Scientific-Technical Progress Under Socialism (K. Yefimov; PLANOVOYE KHOZYAYSTVO, Dec 79).....	18
Relationship Between Science, Production Examined (L. S. Glyazer; EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA (EKO); Nov 79).....	31
Management of Product Quality Control (D. S. L'vov; EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA (EKO), Nov 79).....	41
Stimulation of New Equipment Discussed (V. Astaf'yev, et al.; PLANOVOYE KHOZYAYSTVO, Dec 79).....	54
Net Output, Price Formation Discussed (A. Komin; PLANOVOYE KHOZYAYSTVO, Dec 79).....	67
Production Analysis Using Net Output Norms (V. Paliy; PLANOVOYE KHOZYAYSTVO, Dec 79).....	76
Economic Performance in Uzbek SSR Lagging (V. Dubrovskiy, A. Shulakova; EKONOMIKA I ZHIZN', Oct 79).....	85

GOSPLAN OFFICIAL DISCUSSES CURRENT ECONOMIC GOALS

Moscow NEDELYA in Russian 31 Dec 79 - 6 Jan 80 pp 2, 4

[Interview with Vasiliy Yakovlovich Isayev, first deputy chairman of Gosplan SSSR [USSR State Planning Committee], by K. Rodin and V. Tolpygin]

[Text] [Question] First of all, would you say a few words about the totals for last year? And if you can, would you define its place in the context of the Tenth Five-Year Plan?

[Answer] Last year was a pretty good worker. The nation's economy underwent further development. The scale of social production increased. The well-being of the people was improved. Our defensive might was enhanced. Of course you know that there is an indicator that gives quite a clear picture of the state of the nation's economy, of its overall development. I refer to the growth of national income. Last year national income increased by two percent. Each such percent is measured in many billions of rubles. All in all, in four years of the five-year plan it increased by 16.2 percent. While I do not want to bore you with figures, I think it appropriate to mention two more: the volume of industrial output in the fourth year of the five-year plan increased 3.6 percent and accordingly increased by 20.3 percent in four years.

Such is the progress our country has made last year and in this five-year plan.

[Question] It is natural to ask what is behind these percentages. What is their "weight" expressed not in abstract figures but rather in things we can understand or "feel?"

[Answer] You want to see these percentage points? Let us try: they take the form of approximately one thousand large new industrial enterprises. Among them are the Saiano-Shushenskaia Hydroelectric Power Station, the Kama Auto Plant, "Atommash," and the Leningradskaia, Kurskaia, Chernobyl'skaia, and Armenian atomic power stations. Behind these figures are 1500 kilometers of new tracks on the Baykal-Amur Mainline. Behind them are millions of tons of oil produced in the new Tyumen' fields; 1.5 million tractors supplied to the countryside during the years of the five-year plan; and 423 million square meters of new housing...Behind these percentages are the heroic labor

of the Soviet people and their resolve to carry out the party's plans... Of course this does not mean that everything is as it should be in all sectors of the national economy. While there are objective reasons such as the weather that confronted our agricultural workers last year, there are also subjective reasons, the resolution of which depends on us, on our organization, and on our ability to work as the times demand. Unfortunately, we have not made as much progress as indicated in the plan in such a key area as the further enhancement of the effectiveness and the quality of the work. As a result, the end result falls short of our economic potential.

[Question] As a leading official of Gosplan, what do you regard as unique in the present year?

[Answer] I would answer that question as follows: 1980 incorporates the "end" and the "beginning" -- the end of the Tenth Five-Year Plan and the beginning of the Eleventh Five-Year Plan. In some measure, our work in the current year will set the pace for our economy in the next quinquennium. As you know, the November (1979) Plenum of the CPSU CC emphasized the need for the further dynamic and proportional development of social production, for the consistent implementation of the policy of increasing the effectiveness and improving the quality of the work in all elements of the national economy. Special attention should be concentrated on the growth of labor productivity, on the acceleration of the intensification of production on the basis of scientific and technical progress, on the improvement of the planning and management of the economy.

As regards this year's plan, it is primarily oriented toward the further development of the fuel and raw materials base, of the power industry, machine building, metallurgy, the chemical and other branches of industry, and rail and other types of transport. One of the most important points in the plan stems directly from the party's general line of improving the well-being of the people. This includes producing high-quality foodstuffs in sufficient quantity and assortment. It will be necessary to improve the work of the food, meat-dairy and light industry and of course of trade.

[Question] What is the nature of "Construction-80" on a national scale? What are the principal construction projects and how are they doing? Do you have occasion to visit the building sites?

[Answer] Essentially there is not a single major construction site, be it the Baykal-Amur Mainline, the Tyumen' drilling sites, new atomic or hydro-electric power construction projects, that we are not personally acquainted with. And things are going well primarily on projects where the effort is concentrated, that is, on the large projects... But you want to know what is being built around the country at present.

As you have already noted, this year's plan devotes special attention to the growth of electric power production and the extraction of the basic types of fuel. Power production will grow at a relatively more rapid rate at hydro- and atomic power stations. While in the Ninth Five-Year Plan, they accounted for roughly one-fourth of all capacities put into operation, the presently account for one-half. I would call your attention to such atomic

power stations as the Leningradsкая, South Ukrainian and Chernobyl'skaya stations. Two powerhouses will be put into operation at each of them.

Construction of the Sayanskiy power giant is continuing. Another two turbines will be put into operation and by the end of the year there will be a total of five. A turbine with a capacity of 1.2 million kilowatts -- a figure that would have seemed incredible in the recent past -- will begin operating at the Kostromskaya State Regional Electric Power Station. An 800,000 kilowatt turbine will begin operating at the Ryazanskaya State Regional Electric Power Station. The first powerhouses at the Ekibastuzskaya State Regional Electric Power Station will begin producing current: the Urals and the Center will receive the energy produced by Ekibastuzskiy coal in the form of electricity.

By the end of the year the extraction of oil and gas condensate in the nation compared with 1979 will increase by 21 million tons. The increase will be provided primarily by the West Siberian deposits where oil production will be increased by 32 million tons. Only in this way can we compensate the natural decline in extraction in old fields. The oil fields of the Komi and Udmurt ASSRs, of the Georgian SSR and of Sakhalinskaya Oblast will also increase production. Almost 5500 kilometers of new gas pipelines will be built.

We will produce 2.2 percent more coal which is the equivalent of 16.2 million tons. The basic increase in production is slated for the Kuznetskiy, Karagandinskiy, Ekibastuzskiy, and Kansk-Achinskiy basins. As you see, the East is becoming the country's main coal producer.

New capacities will also be activated at metallurgical enterprises: at the Cherepovetskiy and Novolipetskiy metallurgical plants, at the Rustavskiy combine, in Krivoy Rog, and in the Altay. All this will make it possible to increase the production of pig iron to 115.1 million tons and the production of steel to 156.8 million tons. We will produce 18.5 million tons of steel pipe in the coming year.

[Question] Is that good or bad? After all, we know that plastic pipe has already entirely replaced metal pipe in many countries and pipe production where possible is oriented toward plastics...

[Answer] Like everyone else what has to do with the production and use of pipe throughout the nation, I am in favor of plastic. We believe that in the next few years it will be possible to create such capacities for the production of plastic pipe that will make it possible to conserve many hundreds of thousands of tons of metal a year. But this requires two things: equipment and raw materials, especially chemical raw materials. In this year the chemical industry will significantly increase the production of plastics, artificial fibers, and fertilizers. The geography of construction projects in the chemical industry includes the cities of Cherkassy, Kingisepp, Navoi, Krasnoyarsk, Tomsk, and Chimkent.

Individual facilities will begin operation at the Syktyvkar'skiy Sawmilling and Wood Processing Combine, at the Klyuyevskiy Model-Experimental Timber Procurement Establishment, and at the Kiyevskiy Milling Combine. New docks are under construction in the Leningradskiy, Magadanskiy, Potiyevskiy, Rizhskiy, and Nikolayevskiy ports. Rural regions are building eight live-stock complexes, each of which can accommodate 10,000 head of cattle, and are scheduled to build 14 swine-breeding complexes, each of which will accommodate 50,000-100,000 head...

A large-scale housing program is indicated. Builders will construct 109.4 million square meters of general housing and will put 16,500 kilometers of new pipeline, sewer, heating, and gas networks into operation. The construction of streetcar and trolleybus lines, subways, hotels, theaters, palaces of culture, stadiums, and other facilities is continuing. By the time of the Olympics, many beautiful sports facilities will be put into operation in Moscow, Tallin, and other cities. As you see, in general 1980 will be a year of activation of new structures and capacities.

[Question] Will there be a decline in the number of construction projects this year?

[Answer] Yes, but not to the extent we would like. The fact of the matter is that the number of large new projects -- projects requiring three million rubles or more in capital investments -- have been roughly cut in half. As I have already said, the overall number of construction projects is still excessively large. This is because the commissioning of many projects is delayed and because projects that should have been put into operation last year have been carried over to this year. This is why the efforts of construction and installation organizations and capital investments must now as never before be concentrated specifically on facilities scheduled to begin operation before the entire project is completed. And of course much attention has been devoted to the technical retooling and reconstruction of existing enterprises -- the most effective avenue of reproduction of fixed capital. The allocation for these purposes will amount to 18.4 billion rubles, which is significantly more than the initial targets of the five-year plan.

[Question] In which regions of the nation does development require particular attention today?

[Answer] I would answer your question as follows: all regions of the nation require our unflagging attention. The rates of development are another matter. This year, higher rates are envisaged for the development of the economies of the eastern regions of the RSFSR -- especially the Tyumenskaya Oblast and Krasnoyarskiy Kray -- and of the Transcaucasian republics, Moldavia, Kirgiziya and Uzbekistan. More specifically, the accelerated growth of electric power production, nonferrous metallurgy, chemistry, machine building, light industry, and the food industry is scheduled in the Transcaucasian republics. In agriculture, it is planned to increase the production of grapes, tea,

vegetables, fruit, berries, essential-oil plants, and livestock products. Moldavia will intensively develop viticulture, fruit-growing, machine building and industry associated with the processing of agricultural raw materials. The Central Asian republics will intensively develop electric power production, the chemical industry, light industry, and the food industry. The production of cotton, fruit, vegetables, grapes, and livestock products will be increased. In the Baltic republics, electric power production, chemistry, petrochemistry, instrument building, electronics, and the production of communication systems will develop at a relatively more rapid rate.

It is planned to further improve the siting of the productive forces in economic regions of the RSFSR and the Ukraine. Special mention should be made of the Non-Chernozem Zone of the Russian Federation which is the scene of a major effort associated with the restructuring of the countryside and with the construction of new production facilities.

[Question] We know that machine building is the basis of industry. To what kind of technology will preference be given in 1980?

[Answer] To the technology that is most important today, to technology that today determines the success of our economy's future progress. The plan envisages the preferred growth of production of machinery and equipment for the fuel and energy branches. We have already spoken of their exceptional importance to the national economy as a whole. Priority in this sense is given to technology for agriculture and to various types of equipment for the mechanization of heavy and labor-intensive operations, for the mechanization of loading-unloading and transport operations, and for the improvement of working conditions.

Fifteen hundred obsolete products will be removed from production in the machine building industry. Accordingly, machine builders have been assigned the target of mastering the production of approximately one thousand new products and 350 progressive technological processes and measures for the mechanization and automation of production. Their realization will make it possible to convert 400,000 industrial workers from manual to mechanized labor.

[Question] What measures are being taken to diminish and ultimately eliminate the shortage of such light industry products as cotton textiles, cotton hosiery and linen textiles. In the very recent past, this was all bulk, today it is a problem...

[Answer] The point is first and foremost to increase the production of raw materials from which all these products are produced and simultaneously to expand the production capacities of this branch. I should say that the relatively more rapid growth of the volume of construction and installation work is slated in light industry. Given the insignificant increase in the volume of construction and installation work throughout the nation as a whole, the volume of this work is to increase here by 55 percent! This will make it possible not only to complete all priority construction projects of the year,

but also to create a reserve for the first year of the Eleventh Five-Year Plan and to begin new construction projects slated for activation in the next five-year period. If you are interested in the specific addresses of new construction projects, we can give them. They are above all mills that produce cotton yarn for hosiery and knitted goods and that are being built in Neftekamsk, Makeyevka, and Dolina. The construction of similar enterprises is commencing in Armenia, Azerbaijan and Georgia. The construction of new factories for light industry is scheduled for Moldavia, Uzbekistan, the Ukraine, and the RSFSR.

I would take particular note of the following: we are taking a number of measures designed to reduce the consumption of cotton textiles for production requirements already in the current year and to replace them by artificial fibers or other synthetic materials. This will permit the considerable expansion of market stocks.

[Question] What will this year's contribution be to the development of our agriculture's material and technological base?

[Answer] The contribution will be very substantial. The allocation of capital investment for the development of agriculture is 37 billion rubles. This is a very impressive figure. What will this money be used for? For the construction of livestock complexes and poultry factories, for the construction of farms, for the acquisition of equipment, for the construction of housing, clubs, and kindergartens. Over eight billion rubles are allocated for reclamation work. This year the countryside will receive 344,000 tractors, 270,000 trucks, 293,000 tractor trailers, over 30,000 bulldozers and scrapers, and much other equipment. The chemical industry will supply collective farms with 98 million tons of mineral fertilizers...The present task is to make effective use of this mighty potential and of the material and technical resources that the state is channeling into agriculture.

[Question] What, in your view, is the role of the so-called "social factor" (housing, kindergartens, public dining facilities, working conditions, the climate within the collective, etc.) in increasing the effectiveness of production, in increasing the productivity of labor, and in product quality?

[Answer] It is unquestionably very great. The highest goal of social production under socialism is the most complete satisfaction of the material and cultural requirements of the Soviet people. But under modern conditions, the conditions of developed socialism, the improvement of the well-being of the Soviet people is not only the objective necessity in the development of our society, but is a more and more urgent requirement of our economic development proper and is one of the most important economic prerequisites to the rapid growth of production. Today, man's attitude toward his job, his interest in increasing production and in making production more effective, and especially, in increasing labor productivity and improving product quality are determined not only by the size of his wages, the bonus system and other types of material incentives. To an ever increasing degree, the mood of the worker depends on the quality of housing, on conditions in the workplace, on the availability of kindergartens and day care centers, on the

organization of public dining facilities at the enterprise, and on the micro-climate in the collective (I refer primarily to relationships between people within the collective and the style of leadership), and the nature of organization of the labor process.

It is entirely natural that the recent decree of the CPSU CC and the USSR Council of Ministers "On the Improvement of Planning and the Intensification of the Impact of the Economic Mechanism on Increasing the Effectiveness of Production and Improving the Quality of Work" indicate that sections on the entire complex of measures in the field of social development be developed as a part of the state plans for economic and social development.

As we have already stated, this year will see the implementation of a broad program of housing construction and the construction of cultural, service and municipal facilities. The country will build schools to accommodate 1,174,870 pupils and preschool institutions to accommodate 596,800 children. Clubs and culture centers with accommodations for 255,000 persons will be built in cities and villages.

[Question] What will the year 1980 offer each Soviet person?

[Answer] Real per capita income will increase 2.9 percent (the increase in real per capita income will be 16.6 percent for the quinquennium). Measures will be implemented to increase wages to agricultural workers in the Non-Chernozem Zone of the RSFSR, to pay length-of-service wage increases to rail transport personnel, to provide pensioners with increased material motivation to work in the national economy, to improve pensions for kolkhoz workers, to increase grants to lifelong invalids, and other measures. Payments will be made in connection with the regularization of rates and salaries in the nonproductive branches in the current year, with the introduction of wage increases and other benefits in rail transport in Siberia and the Far East.

Provision is made for the further increase in the population's money incomes. The average monthly wage of workers and employees will increase to 167.3 rubles or by 2.1 percent while wages of kolkhoz workers will rise to 118 rubles or by 5.4 percent.

And most important: our country will become richer and stronger. Its economic potential will grow and strengthen still further.

5013

CSO: 1820

IMPACT OF SCIENTIFIC-TECHNICAL PROGRESS ON THE EFFECTIVENESS OF PRODUCTION

Moscow PLANOVOYE KHOZYAYSTVO in Russian No 12, Dec 79 pp 3-10

[Article by Ya. Ryabov, first deputy chairman of Gosplan SSSR [USSR State Planning Committee]]

[Text] The key issue in the present stage of socialist construction is to increase the effectiveness of social production. The resolution of this issue is associated with the comprehensive intensification of production, with the economical use of all types of resources, and with the production of products that would more completely satisfy the people's social and personal requirements for smaller labor inputs.

The economy of the USSR is developing at a rapid rate. In a shorter period of time than the last three five-year plans national income has more than doubled, the volume of industrial production has increased 2.5 fold, and agricultural output has increased 1.4 fold. During this period the value of fixed productive capital increased 2.8 fold and surpassed the trillion ruble mark. We have thus created a mighty production potential that is capable of ensuring high and stable rates of development for the nation.

The list of technical means, which is one of the important indicators of acceleration of scientific-technical progress in implements of labor, was expanded by 13,800 items between 1971 and 1978. It is expected to increase by another 3000-3500 items before the end of the five-year plan.

The level of mechanization and automation of production has been raised. In 1978 industry numbered more than 130,000 totally mechanized lines (compared with 83,000 in 1970 and 43,000 in 1965) and 23,000 automated lines (compared with 9500 and 6000, respectively).

ASU (automated control systems) and especially ASUTP (automated control systems for technological processes) are being created at a rapid rate. On 1 January 1971 there were 414 ASU, including 170 ASUTP, and in 1978 there were more than 3800 ASU, including 1324 ASUTP. The sophisticated production processes at large newly built and rebuilt chemical, petrochemical and metallurgical production facilities and at electric power stations are now controlled with the aid of ASUTP.

Between 1971 and 1975 the rise in the technical level of production at existing industrial enterprises reduced the enterprise cost of production by 12 billion rubles. This reduction should amount to 16 billion rubles in the current quinquennium.

Socioeconomic problems require the search for new and effective avenues of economic development and the most effective utilization of the created potential. At the November (1978) Plenum of the CPSU CC, L. I. Brezhnev, General secretary of the CPSU CC and chairman of the Presidium of the USSR Supreme Soviet, noted that the difficulties that impede economic growth and the solution of social problems consist in the fact that the central economic agencies, ministries and departments are remiss in converting the economy to the rails of intensive development and have not improved the qualitative indicators of the work or the acceleration of scientific-technical progress.

The decree of the CPSU CC and the USSR Council of Ministers "On the Improvement of Planning and Intensifying the Impact of the Economic Mechanism on Increasing the Effectiveness of Production and Improving the Quality of the Work" articulated a system of measures for the further improvement of planning and management at all levels. The accelerated development of scientific-technical progress and the more complete utilization of advances of science and technology in the practice of socialist construction is very important in this regard. The successful solution of this problem creates an objective possibility for dramatically increasing the effectiveness and improving the quality of the work of all branches of the national economy.

The Soviet Union leads the world in basic and applied research and disposes over a vast material-technical scientific base and a broad network of project-planning, surveying, experimental-design, technological, and experimental organizations. However scientific and technical advances are not always fully and effectively used in the national economy. Analysis of the reason for this situation shows that this is primarily due to the lack of a clear-cut interrelationship of basic and applied research with experimental work and is also due to shortcomings in the diffusion and broad production of new equipment. In planning the direction of scientific-technical progress and the expenditure of funds on research and development, the available results of such research and development are not by any means fully considered in plans for the development of individual branches and of the national economy as a whole.

The development of the socialist economy, especially in the last three quinquennia, has confirmed the timeliness and correctness of the historic decisions of party congresses. The party's policy of intensification is embodied in the creation of highly effective processes and production facilities, machinery and equipment, in the improved quality of materials, and in the better organization of production.

However the plans for social and economic development have not always reflected the priority development of branches that determine technical progress. Thus the deficient allocation of material and financial resources

has precluded the required relatively more rapid growth of branches--especially the instrument building and machine tool building branches--that produce the means of production. At the same time, ministries have not always secured the requisite return on resources especially in the creation of new production capacities and in the running-in process.

Given the immeasurable increase in the scale of production in the present stage of economic development, economic relations have become more complex and the role of planning, including the planning of scientific and technical progress, is intensified. The acceleration of scientific-technical progress and the raising of its effectiveness depend to a considerable degree on the continuousness of transition from one stage to another in the creation, diffusion and application of new technology. The continuousness of this cycle ensures the program-goal planning of technical progress.

However the scientific-technical programs ratified for the Tenth Five-Year Plan do not ensure the full "research-production-application" cycle. The programs do not devote proper attention to the concluding stages and the diffusion of new technology ends only with the preparation of series and with the verification of solutions at the head project. Targets are not always set for the technological development of products and for the organization of their series production.

Practice shows that the realization of scientific-technical accomplishments is interrupted in this very stage owing to various factors (the lack of production capacities, necessary components, raw materials, supplies, etc.). As a result, series development is delayed, the product of development becomes obsolete, new technology does not always fit the production plan after the production of the reference batches, and the requirements of the national economy are not fully satisfied.

The cycle from the beginning of the design stage to commercial production runs 10-12 years, i. e., exceeds the service life of the active part of the productive capital and the birth of new technical ideas. This is how matters stand with the T-130 tractor; the Chelyabinskiy Tractor Plant has been unable to organize the production of the given tractor since 1972. A tractor that is urgently needed by the national economy has been undergoing state tests for seven years at the Cheboksarskiy plant. Unfortunately, such examples are also numerous in other branches of machine building, metalworking, ferrous and nonferrous metallurgy, chemistry, etc.

The absence of concluding stages in the realization of scientific and technical advances within the framework of the existing programs is a serious shortcoming that does not make it possible to realize all the advantages of programmed planning.

In accordance with the aforementioned decree of the CPSU CC and the USSR Council of Ministers, the program-goal method of planning will undergo further development. The reference is to the elaboration of scientific and technical programs that would ensure the completeness of the entire cycle of planning of scientific and technical progress from the research and development stage to the introduction of new technical means and technological processes on the part of the customer. These programs must envisage all

necessary measures for the comprehensive resolution of the problem with regard to the final technical and economic result.

The comprehensiveness of scientific-technical programs, their orientation toward high final national economic results, toward the raising of the technical level of individual branches will be enhanced when the planning of these programs includes series production targets and targets for the utilization of new technology including an increase in production capacities, the construction of new enterprises, the reconstruction of existing enterprises, and resource availability. Special attention must be devoted to the last-named point which is frequently associated with the creation of new materials and components and which depends on a number of ministries and agencies. The underevaluation of the given questions can lead to a sharp decline in effectiveness from the realization of the indicated measures. For example, the capacity of the 2000 mill at the Cherepovetskiy Metallurgical Plant is not fully utilized as a result of the shortfall in the deliveries of steel billets by other enterprises by enterprises belonging to the same USSR Ministry of Ferrous Metallurgy.

Products of the radioelectronic industry, the technical and economic parameters of which are continuously being improved, are being produced at an accelerated rate. The last few years of the current five-year plan alone have witnessed the production of super-large integrated circuits, micro-processors and micro-computers. For several years, this industry has been unable to organize the production of YES-1035 and YES-1060 computers capable of approximately 200,000 and 1,000,000 operations a second respectively. The reasons are the lack of preparations for production, the lack of resolution of a number of technological problems, and the failure to gather the necessary components.

The Ministry of the Radio Industry, whose enterprises produce computers, and the ministries of the electronics industry and the electrical equipment industry, which participate in the fabrication and delivery of components for them, must more closely coordinate plans for the production of these machines and components.

The need for a comprehensive approach to scientific and technical programs is graphically demonstrated by the example of the automation of control, which is one of the means of resolving economic and social problems and as experience shows is one of the most effective ways of using capital investments. The efforts of many scientific research and project-planning organizations are directed toward the resolution of this important national economic problem. Machinery and equipment, technological processes and production facilities are widely equipped with automated systems.

For example, we have mastered the production of machine tools with numerical programmed control (ChPU), the use of which ensures high labor productivity and good product quality. However this progressive equipment is not used effectively at industrial enterprises. As we know, the maximum effectiveness of

equipment with ChPU can be achieved only when used in tandem in sectors and on lines, i. e., the resolution of the automation control problem requires a higher level of organization of production. But the use of this equipment has not yet reached the required scale.

The chemical and oil refining branches of industry are among the users of automated systems. Control and measurement systems are commonly included in the design of technological processes and units. But the instruments and transducers that are needed when equipment is put into operation cease to perform their functions in the period of industrial operation which, according to scientific research and project-planning organizations, immobilizes roughly half of the expenditures on automation. At the same time, there is every opportunity to attain a new quality of management which excludes such unjustified losses.

Recent years have seen the organization of the series production of so-called mini-computers that have been widely used in the management of technological processes and production facilities. Scientific research organizations and manufacturing plants of the Ministry of Instrument Making, Automation Equipment and Control Systems and of the Ministry of the Electronics Industry have done much to improve their technical and economic parameters. Computers of this class have the same design and production technology and sophisticated basic and applied software. The reliability of their operation has been raised significantly. All this has made it possible to make wide use of mini-computers in the control of complex technological processes and equipment in power production, in ferrous and nonferrous metallurgy, in branches of chemistry and petrochemistry, etc. Suffice it to say that the given technology has been the basis for the creation and successful operation of automated systems for planning production, for distributing electric power, for controlling smelting processes in blast furnaces and convertors, and for controlling oil extraction and refining processes. Capital expenditures on the creation of such systems are 25-50 times more effective than expenditures on basic production.

But all the same, the question of the effective use of computers has not been resolved. Nor has the production of a number of sensors, instruments, transformers and slave mechanisms been mastered. The designs of basic technological equipment do not always take into account considerations associated with the automation of control. It is sometimes disadvantageous to the Ministry of Instrument Making to produce made-to-order sensors. As a result, the existing design solutions on the automation of control cannot be widely diffused. But the operation of such systems, e. g., in the production of paper on domestic and imported equipment, has shown that expenditures of 100,000-150,000 rubles can raise the productivity of powerful papermaking machinery by 15-20 percent.

The absence of a complete solution to the given problem lowers the effectiveness of the impact of automated systems on production. This question is not new. There were attempts to solve it, e. g., in the automation of the production of rolled metals in ferrous metallurgy. The order of five

ministries -- requestors of tooling up for production and contractors participating in the development and production of basic technological equipment, instruments, sensors, drives, and electrical equipment -- was ratified. However this form of realization of a major national economic problem proved to be ineffective. Since it was not considered in the plan, resources were not made available for the development of the production capacities required to produce the necessary equipment.

The elaboration and implementation of comprehensive programs of scientific and technical progress depend on the smooth interaction of the USSR Academy of Sciences, the USSR State Committee for Science and Technology, Gosplan SSSR, ministries, agencies and their organizations in all stages of this process starting with the formulation of a list of programs for the five-year plan under consideration and for the long run. Scientific and technical programs that must culminate in the creation of new production facilities and the introduction of the results of R & D on an optimum scale require the in-depth elaboration of organizational guidelines regulating the formulation and implementation of programs. Work in this direction is presently under way in planning and economic agencies. Special-purpose scientific and technical programs must become a key instrument in solving socioeconomic problems: the problem of increasing labor productivity, the problem of economizing on raw materials and supplies, and the problem of reducing the share of manual labor.

The consistent application of a system of indicators of the technical level of production, in addition the amplified role of the program-goal method, is an important condition to attaining optimal final socioeconomic results from the introduction of advances of science and technology. The decree also devotes much attention to this question.

In the current quinquennium, a system of indicators of the technical level of production and output has been incorporated in the national economic plan. This has amplified the planned state impact on the improvement of the work of branches and the monitoring of the implementation of technical policy. However in a number of instances the existing indicators either do not reflect or else incompletely reflect the basic directions of technical progress and have narrow branch significance. They do not secure an effective relationship of the plan for the introduction of scientific and technical advances with other divisions of the national economic plan: production plans, capital construction plans, labor and social development plans, enterprise cost of production and profit plans. The system of these indicators must influence the qualitative structure of products: must raise the share of progressive types of products; must improve the technological base of branches or production facilities; must improve the utilization of equipment; must expand the application of fundamentally new and progressive processes; must raise the level of mechanization and automation of production; must reduce the labor-intensiveness, materials-intensiveness and energy-intensiveness of production; and must increase the reliability and service life of products.

In the interest of the maximum consideration of the tasks and results of scientific and technical progress in Basic Directions of Economic and Social Development of the USSR Up to 1990 and for 1981-1985, Gosplan SSSR and the USSR State Committee for Science and Technology are developing a new system of indicators of the technico-economic level of production and output. USSR ministries and agencies must draft proposals to re-define a system of indicators so that they would to the maximum degree reflect the specific features of the main tasks of scientific and technical progress in branches of the national economy. In the elaboration of the new system of indicators, it is essential that each indicator provide the information needed to determine the general economic effect in monetary or physical terms or in the saving of live labor.

An important aspect of the acceleration of technical progress is that it brings the scale of production and introduction of new technical means and materials into line with the requirements of branches of the national economy. Priority in the organization of series production must be assigned to new technologies and materials that produce a significant saving of fuel, electric power, metal and that bring about a reduction of labor inputs. For example, the world's largest powerhouse with a single-shaft 1.2 million kilowatt turbine is slated to be put into operation at the Kostromskaia State Regional Electric Power Station in 1980. The introduction of such powerhouses reduces capital expenditures on construction to 10 percent and makes it possible to reduce the per unit number of service personnel by 40-50 percent and to realize a 3 percent saving of fuel. Experience gained in the operation of this powerhouse can serve as a basis for recommendations on the development of power machinery of still greater capacity including turbines for atomic power stations of the future.

It is essential to accelerate the organization of the industrial production of such new polymer structural materials as polysulfon, polybutylaterephthalate and other substitutes for nonferrous and ferrous metals including stainless steels.

The application of progressive tungstenless brands of hard alloys and fast-cutting powder steels in the production of cutting tools can mean a significant saving of scarce alloying additives (tungsten, molybdenum, etc.) and can increase the labor productivity of machine operators by 15-18 percent. It is essential to accelerate rates of development of the production of such materials.

The application of automatic programmed-control manipulators is a promising direction in the comprehensive automation and mechanization of production. Calculations and experience show that one industrial robot does the work of 2-4 workers and increased labor productivity 2-4 fold. New technology plans and production plans must devote particular attention to the expansion of the mix and to increasing the scale of production of robots.

The volume of production and introduction of new types of products and the corresponding requirement for them must be articulated in five-year plans of development of science and technology and in production plans. The most

The most important types of series produced products must be transferred from the new technology plan to the annual product mix plan ratified by the USSR Council of Ministers or Gosplan SSSR while the remaining part of the new products must be listed on a separate line in ministry production plans. In the methods and forms used to draft five-year and one-year plans, it is expedient to make rigid demands on manufacturing ministries relative to the determination of the requirement for new types of products and to submit the data obtained to Gosplan SSSR together with draft plans.

The plan for the series production of new types of industrial products must be compiled with due regard to scientific and technical programs and ratified systems and complexes of machines. While the production of machinery and equipment is for the most part planned for the performance of specific operations, under the new conditions it is essential to plan the production of complexes that ensure the execution of complete technological processes. Highly productive equipment, especially as a part of complexes and systems of machines, in turn requires radical organizational restructuring in the process of its operation and the organization of planning ensuring a maximum effect from the use of this equipment.

Higher demands are made on standardization. In the process of revising obsolete standards and of devising new standards on machinery and equipment, it is essential to include requirements that reduce the mass of the product, that reduce the expenditure of fuel and energy in the process of operation, and that envisage the standardization of assemblies and instruments. Standardization plans must contain coordinated demands on raw materials, components and finished products, must be coordinated with branch and interbranch scientific and technical programs and thus must ensure the high quality of newly created equipment. Considering the great importance of reducing the material-intensiveness of products, for each new type of product included in the plan it is essential to employ the indicator of saving of ferrous and nonferrous metals that is attained with the new product in comparison with the existing analogs.

For the drafting of five-year and one-year plans, the decree calls for the compilation of a 'passport' for each production association (enterprise). The passport contains data on the availability and use of production capacities, on the organizational-technical level and specialization of production and on the growth of labor productivity due to measures to raise the technical level of production. The compilation of passports must be completed in 1980.

The planning of targets on the introduction of scientific and technical advances in the national economy should also be effected through plans for new construction projects.

One of the principal points in the decree is connected with the final national economic results of the introduction of new technology. The effectiveness of its introduction is presently determined by its cost evaluation. But this evaluation must serve as the expression of the actual saving that the national

economy realizes in the form of reduced expenditures of labor, materials, energy, and fuel in production and in the reduction of production losses to a minimum.

Norms for all types of expenditures must be a most important yardstick of technical progress in the national economy. Work on five-year plans of social and economic development must be organized in such a way that the requirement for all types of material resources and capital investments would be determined on the basis of the progressive dynamics of existing norms. It is common knowledge that norms are the mirror of technical progress. Accordingly, decision-making on scientific research and project-planning work, on the production of new products must be examined through the prism of the system of normed indicators of effectiveness. Calculations of basic technico-economic indicators of plans of social and economic development must be based on norms that ensure high effectiveness in the realization of scientific and technical advances.

The acceleration of scientific and technical progress requires serious restructuring in many directions. This task must be realized both by central government agencies and by ministries and departments. The decree envisages a complex of measures to increase economic motivation to attain a high technical level of production and output and to increase the responsibility of collectives for the quality of the work. Project-planning and the construction of new enterprises and the expansion and reconstruction of existing enterprises must be based on highly effective production technologies and the latest equipment which can ensure production at the level of the best domestic and foreign attainments.

The conversion of scientific research, design, and technological organizations and the production associations (enterprises) of industrial ministries to a cost-accounting system of organization of work on the creation, development and introduction of new technology on the basis of orders or contracts is an important measure. The most important feature of the cost-accounting system is the assessment of the end result: the volume of introduction of new technology and the national economic effect realized in the process; economic incentive funds for given works and for rewarding scientists and production workers will be created accordingly.

The decision to include the cost of industrial work associated with the development and introduction of new technology financed by the unified fund for the development of science and technology in the overall output volume eliminates the contradiction between the output volume of associations and enterprises and the right to expend funds on diffusion.

These and other measures envisaged in the decree are designed to secure a high technical level of new development, to reduce the lead time of new products, and to increase the production of highly effective products.

In the light of points contained in the decree, it is essential to make certain changes in the work practices of both central planning agencies and ministries and departments. This must be done in the compilation of the Eleventh Five-Year Plan. Special attention must be devoted to the in-depth elaboration of the Comprehensive Program of Scientific and Technical Progress and Its Socioeconomic Consequences Up to the Year 2000 by the USSR Academy of Sciences and the USSR State Committee for Science and Technology. Given the limited labor, material and financial resources the task of Gosplan SSSR is to determine the optimal scale of diffusion of scientific and technical advances in conjunction with commissions of the USSR State Committee for Science and Technology and the USSR Academy of Sciences. The Comprehensive Program submitted to Gosplan SSSR must be widely discussed with scientific research organizations of ministries and departments so that the particular features of development of each branch can be considered to the fullest in planned period. In the process of reviewing drafts of the Eleventh Five-Year Plan, it is important that ministries would maximally consider proposals included in the materials of the Comprehensive Program. Such organization of the work will enable Gosplan SSSR to ensure that the Eleventh Five-Year Plan will provide for the most rational use of resources and will define ways of effectively developing our economy.

Gosplan SSSR is continuing its effort to improve the methodology of planning the development of science and technology. Taking into account the tasks stemming from the decree, the experience gained in the elaboration of materials for the Basic Directions of Economic and Social Development of the USSR Up to the Year 1990 and for 1981-1985 and proposals by ministries and departments the necessary amendments and addenda will be made in the Guidelines on the Elaboration of State Plans of Economic and Social Development of the USSR in the Eleventh Five-Year Plan.

The realization of the tasks stemming from the decree of the CPSU CC and the USSR Council of Ministers on the improvement of the economic mechanism will be one more step in the realization of the pronouncement of the Twenty-Fifth CPSU Congress on raising the effectiveness of social production and on improving the well-being of the Soviet people.

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SCIENTIFIC-TECHNICAL PROGRESS UNDER SOCIALISM

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[Article by K. Yefimov, Scientific Division of USSR Gosplan: "Developed Socialism and Scientific-Technical Progress"]

[Text] Developed socialism is a law-governed stage of communist social formation. In the sphere of productive forces, it is characterized by the presence of a powerful national-economic complex encompassing all links of national production. The high level of production has guaranteed the prerequisites for the fuller satisfaction of the material and cultural needs of all members of society. Socialist production relations are creating a wide scope for the operation of economic laws.

The necessity of an organic combination of the achievements of scientific-technical progress with the advantages of developed socialism corresponds to the goals and tasks of the building of communism. This combination has a complex character, it reflects the optimal balance of the parts and phases of scientific-technical progress and in the final analysis its highest rates in every phase and at every moment of time. The possibility of such a combination appears as the manifestation of the historic advantages of developed socialism.

In our time, science has turned into a determining and decisive factor of the perfection of production. Without scientific investigations, it is impossible to improve the means, objects, and products of labor, the technology and organization of the production process. It is precisely because of this that science has turned more and more into a direct productive force of society, an integral technological element of production, the basis for the growth of its deficiency.

Scientific-technical progress signifies the appearance of in principle new types of machines and technology, sources of energy and raw material, means of labor, forms of transportation, and so on. Electronic computers carrying out control functions are finding ever wider application. This has introduced conceptual changes into the system of machines. The tra-

ditional systems consisted of three links: the driving engines, machine tools, and transmission equipment. Electronic computer technology became the fourth "thinking" link. Thus the prerequisites have been created for the transition from the simple cooperation of machines to a system of machines and apparatus based on the principles of automation and continuity of processes, to the creation of complicated automated complexes involving the use of cybernetic systems.

The development of the chemistry of polymers made it possible to create materials with purposeful qualities--ultra-strong or fire-proof alloys, new composition materials, plastics, and others. New means are being developed to influence weather and climatic conditions, the soil, the productivity of agriculture and livestock-raising.

Technological progress is bringing about important changes in the technology and organization of industrial and agricultural production, construction and transportation. The specialization of different types of work is growing. There is rapid renewal in the list of products turned out, both for production and technical purposes and for personal consumption. According to the calculations of specialists, during the decade ahead more than half of the articles of popular consumption will be items about which the consumer earlier had no idea.

Radical changes are taking place in the technological content and the conditions of labor, the principles of its organization, the way of life of people. The mobility of the population is expanding, its general education and qualification level is increasing. New professions and industrial types of work are making their appearance, the demands for the intensification of the national economy are growing. Changes are taking place in the family structure under the influence of the involvement of an earlier unutilized able-bodied part of the population in national production and the saturation of the household with new utensils, especially consumer durables. The development of the social service sphere is creating the preconditions for reducing the expenditures of labor in everyday life.

Scientific-technical progress called forth the appearance and further development of atomic energy, electronic computer technology, space technology, radio electronics, and so forth. In traditional industries (metallurgy, fuel industry, and others), there is a qualitative improvement not only in technology and equipment, but also in the structure of production and the organization of labor. The role of the infrastructure has increased.

Important quantitative and qualitative changes are observed in science, in the organization of scientific work. The unprecedented growth of the scales of contemporary science required the creation of a powerful material-technical base for the conduct of scientific research. The network of scientific organizations is expanding in industry, agriculture,

the sectors of the infrastructure, and the service sphere, the relative weight of scientists and specialists in all branches of the national economy is growing. Science is deeply penetrating into all sections of the administration of the state and the economy. It is turning into an actively operating element of modern material and spiritual culture, exerts an ever-growing influence on the perfection of social relations. This makes it possible to create such social problems as the liquidation of the differences between town and country, between mental and physical labor, the liquidation of heavy, harmful and unattractive work.

Scientific-technical progress is not a national phenomenon, but the result of the historical development of mankind. Therefore, some of its features have elements that are common for socialist and capitalist countries. However, scientific-technical progress under socialism has a different character and an essentially different organizational and social direction than under capitalism.

In capitalist society, the social character of scientific-technical progress is determined by the capitalist production relations of its direction, the scales and tempi are conditioned above all by the interests of the monopolies. The interests of society as a whole are taken into account only to the extent to which they coincide with the interests of the monopolies; in other cases, they are ignored. The determining influence of the monopolies on scientific-technical policy expresses itself negatively, above all, in the development of science, social conditions, and the environment. To the old afflictions of capitalism (unemployment, inflation, malnutrition), scientific-technical progress adds new ones (the overpopulation of the large cities, the growth of crime, the pollution of the environment, and so on). The reality of the capitalist countries provides no grounds for identifying scientific-technical with social progress. Social progress is measured not so much by technical achievements as by socio-economic achievements, by the level of the liberation of the workers from the blind subordination to elemental and social forces.

The contradictions of capitalism find expression in the growth of unemployment. That contrasts sharply with the stable development of the economy of the USSR, which guarantees full employment.

Socialism opens up broad possibilities not only for the planned development of science and technology, but also for the control of social processes. With the development of society, the possibility of solving social problems will expand, and the means of their realization will be perfected.

Promoting the growth of labor productivity in material production, technical progress under the conditions of socialism makes it possible to direct an ever greater share of labor resources into the sphere of production of services for the population, the dissemination of services,

and spiritual goods. Thus, during 1950-1977 the number of people employed in the given sphere increased from 8.9 million to 33.2 million.

The accelerated development of the sectors of the non-productive sphere, their extensive equipment with modern technology are not only a consequence, but also an important condition of scientific-technical progress. As a result, the leisure time of workers is increased--which is of great significance for the formation of harmoniously developed people.

The practice of the Soviet state and other socialist countries testifies to the fact that scientific-technical progress in our time signifies a new level in the rule of people over nature and their own social relations. The fullest use of the possibilities of this is one of the most important tasks of the organic combination of scientific-technical progress and the advantages of the socialist system of the economy. However, it would be incorrect to suppose that the stated task can be solved automatically. The advantages of socialism are manifested, above all, in the conscious organization of social relations, socio-economic and other processes, and this is assured on the basis of the cognition of objective laws and the perfection of the mechanism of their use through a system of control.

Proceeding from the main goals of the development of the socialist economy with allowance for our native and for world experience in the development of science and technology, the 25th CPSU Congress formulated the most important directions of the development of scientific research in the sphere of the social, natural, and technical sciences. In conformity with the decisions of the Congress, a wide range of fundamental investigations and technical elaborations is being carried out in the sphere of the natural sciences--investigations and elaborations which determine the scientific-technical potential of the country.

Research in the sphere of theoretical and applied mathematics, work on the perfection of the physical and mathematical foundations of electronic computer technology are directed toward the creation of highly-effective systems for controlling complex technological processes, large integrated sets of machinery and factories, toward the increase of the effectiveness of the application of electronic computers in the national economy. Research in the sphere of physics of elementary particles will speed up the solution of a series of important questions of nuclear physics, and above all of the technical perfection of nuclear energetics. In the sphere of quantum electronics, optics, radiophysics and physical electronics, the physics of solids and low temperatures, new types of lasers are being created, as well as optical and radioelectronic instruments, new means for the transmission and processing of information, new structural magnetic semiconductors, super-conducting and other materials, and also technically valuable crystals.

In the current five-year plan, work is being done on a wide front on the whole complex of the chemical sciences, and in the first place on the

of chemical compounds for obtaining substances and materials with the desired characteristics, the creation of new chemical-technological processes, which guarantee the increase of the intensification of chemical production. A lot of attention is being given to the expansion of research in the sphere of molecular biology, the physical-biological bases of the life activity of the human organism with the goal of the successful solution of the medical-biological problems of the fight against cardio-vascular, oncological and other diseases. Intensive work is being done to obtain new physiologically active substances for medicine and agriculture, and also research on the theory and methods of genetics, connected with the creation of new varieties of plants and highly-productive strains of agricultural livestock. There is significant expansion in the research conducted for purposes of the development of scientific bases of the rational utilization and preservation of soils, mineral wealth, plant and animal world, air and water basins.

The economic strategy of the party formulated by the 25th CPSU Congress includes among the current tasks demanding a solution on the basis of the maximum use of the achievements of science and technology, above all, a rapid growth in labor productivity, a sharp reduction in the share of manual labor, the complete mechanization and automation of production. The stated tasks acquire special urgency in connection with the aggravation of the problem of labor resources. An important means of their solution is the uniform technical policy of the state, which is aimed at the attainment of a high technical level of production and the output produced. Its essence lies in the determination of the main directions of the development of science and technology, in their agreement and in the realization, on this basis, of a complex of basic and applied research and elaborations, operationalizations, the organization of production and the application of new production and technology on an optimum scale.

Thus, the state policy with regard to science and technology serves as the connecting link between the economic policy of the socialist state and the complex "science--technology--production".

During the past few years quite a few essentially new highly-effective technical ideas and solutions have been implemented.

In energetics the tempi of the construction of atomic power plants are intensifying, especially in the European part of the country. Regardless of the fact that their cost is significantly higher than thermo-electric power stations of such capacity, atomic power stations for a given region prove to be sufficiently profitable thanks to the economy of expenditures for fuel. Moreover, there is a tendency to magnify the real national economic expenditures for the extraction of every additional unit of organic fuel and for the production of electric power from it. This, and also the rapid technical-economic progress in nuclear energetics, is conducive to the continuous increase of the national-economic significance of the nuclear energy stations.

No less important is the impact attained through the economy of organic fuel. The scales of the nuclear power plants put into operation during the current five-year plan envisaged by the decisions of the 25th CPSU Congress correspond to a saving of approximately 50 million tons of conventional fuel. The additional extraction and delivery of this fuel from the eastern regions of the country, in the absence of nuclear power stations, would prove to be, obviously, impossible, and that means that a number of important national-economic tasks connected with the development of electroenergetics would also be impossible.

In heavy machine building rolling mills for components are being introduced. Now 63 such mills are working in industry, guaranteeing an annual output of more than 300,000 tons of precise castings. Moreover, there is a significant increase in labor productivity, and the economy of the metal amounts to 18 percent of the mass of the article produced on the average. For example, to satisfy the demands of the livestock farms for pins for linked transporters, 600 units of metal-processing machine tools were required. They were replaced by 12 machines for screw rolling that made it possible to increase the productivity of labor by a factor of 30 and to reduce the scrap metal during processing.

At the Dneprovskiy Metallurgical Plant imeni Dzerzhinskogo the first mill for rolling railroad car axles in the world was introduced, representing an automated line with full mechanization of all operations. It produces 360,000 axle units a year. Its use made possible a sharp increase in labor productivity and a saving of 20,000 tons of high-quality steel a year by virtue of reducing the processes for the subsequent mechanical processing.

Work on the creation of artificial diamonds, mineral ceramics, hard alloys on a non-tungsten basis produced an enormous economic impact in machine building. Only recently the plasma-mechanical method of metal processing was used only in individual machine building enterprises. During the coming year, hundreds of plasma generators will be manufactured and used, and during the next five-year plan--thousands.

The practical realization of the elaborations of the Institute for Electric Welding imeni E. Patona and a number of other organizations with regard to multilayer pipes for the main high-pressure gas pipelines. According to the calculations of specialists, in a gas pipeline of 3,000 kilometers in length a saving of approximately 1 million tons of pipe can be obtained.

In principle new technical solutions have been introduced in the development of gas deposits and the pumping of gas. In 1978, 139 billion cubic meters of gas were extracted with the aid of new complexes of automated equipment for highly-productive wells of large diameter. Gas transfer assemblies, created on the basis of air turbines which have used up their air resource, have demonstrated exceptionally high efficiency in

work on gas pipelines. According to calculations, this makes it possible to economize hundreds of millions of rubles.

In recent years, in principle new technology has been introduced in the hot rolling of sheets from composition materials, combining a metal die and super-strong fibers. Their specific strength is 15-20 times higher than ordinary metal materials, and their reliability is 8-10 times higher. In addition, they possess great elasticity, which is maintained through a wide temperature range. By introducing the necessary quantity of different fibers into the metal one can create materials with the required technical characteristics.

Specialists of the Moskabel' Plant, in cooperation with scientists, have created new technology and equipment for the welding and corrugation of thin walled coatings of long-distance communication cables made of aluminum and steel bands instead of the lead coatings. The realization of this idea will result in the economy of up to 100,000 tons of lead during a 5-year period; moreover, thanks to the high level of automation of the machine complex of continuous operation, it was possible to bring about a sharp increase in labor productivity.

These solutions can also find applications in other industries.

There is an increase in the production volume of the output of machine units and installations of large individual capacity, which are built on the basis of progressive technological models, with a reduction of the number of phases of the technological cycle, the acceleration of rates by virtue of the use of active catalysts and other active influences, the utilization of byproducts, the use of heat given up during chemical reactions, and so on. As a rule, during the introduction of such installations and machine units the productivity of labor increases almost by a multiple of the growth of the individual capacity of the equipment; the specific metal-intensiveness of the products is lowered by 7-10 percent, and the cost of a unit of equipment capacity--by 5-15 percent. For example, the production of ammonia in plants with a capacity of 400-450,000 tons a year in 1979 will amount to about 35 percent of the total output compared to 16 percent in 1975; of ammonium nitrate in plants with a capacity of 450,000 tons a year--correspondingly more than 27 percent compared to 18.8 percent. In ferrous metallurgy powerful converters have been put into operation, including ones with a capacity of 350,000 tons, guaranteeing an output of more than 3 million tons of steel a year.

At the present time, an experimental-industrial check is being conducted of the production technology of highly-filled polymers, the use of 1 ton of products made from which, according to calculations, can bring about a saving of 2,000 rubles minimum. A broad experimental-industrial check is being conducted of the radiation processing of grain in elevators, which guarantees, according to experimental data, a highly-effective process of disinfection.

By virtue of increasing the technical level of production in operating enterprises of industry, 2 million people were transferred from manual labor to mechanized labor during 1971-1975. In the current five-year plan this figure amounts to more than 2 million people. By the end of 1980 the work of approximately 65 percent of the workers in industry as compared to 58 percent in 1978 ought to be mechanized.

In solving the tasks of the development of science and technology, our country attentively watches the achievements of other countries. The forms of the utilization of world scientific-technical achievements are varied. They include, first of all, the growing practice of effective scientific-technical cooperation and collaborative work within the framework of the Council for Mutual Economic Aid (CEMA). Such cooperation is expressed in the plan of joint research, the coordinating commissions of CEMA, and the bilateral intergovernmental commissions. The ministries and departments, in working out the plans for the technical development of the sectors of the national economy and in determining the time period for achieving of an advanced technological level, decide what can be done through our own efforts, what can be achieved through cooperation with CEMA member countries, what licenses and equipment it is expedient to purchase in other countries in order to solve the tasks that have been set more quickly.

Scientific-technical cooperation with the capitalist and developing countries is acquiring ever greater significance for the acceleration of scientific-technical progress. The USSR State Committee for Science and Technology, on the basis of proposals of the ministries and departments of the USSR and the councils of ministers of the union republics, works out appropriate measures which have the goal of the mutually advantageous utilization of scientific-technical achievements. These measures encompass a wide range of problems with regard to the preparation of Soviet licenses and their sale abroad, the purchase of foreign licenses and technical equipment, the operationalization of purchased licenses in production.

Now that a powerful production potential has been created and economic relations have become complicated, the role of the planning of scientific-technical progress in the solution of economic and social problems has increased. This was underscored at the 25th CPSU Congress also in the speeches of L. I. Brezhnev. The decree of the CPSU Central Committee and the USSR Council of Ministers "On the Improvement of Planning and the Strengthening of the Influence of the Economic Mechanism on the Increase in the Efficiency of Production and the Quality of Work" envisages a complex of organizational and economic measures guaranteeing comprehensive consideration of the achievements of science and technology in the plans of economic and social development.

The targets of increasing the output of products of the highest quality category must be important indicators in the production plan. The targets of reducing the use of manual labor will be reflected in the plan with regard to labor and social development, the targets of reducing the norms of expenditure of material resources--in the section on material-technical supply.

The assimilation and introduction of new technological processes and products in enterprises and projects newly put into operation will become mandatory tasks in the construction of new, and the expansion and reconstruction of existing enterprises and will be taken into consideration in the plans concerning capital construction. Important changes are being introduced in the plan for the introduction of new technology. Of increasing significance are the complex special purpose scientific technical programs, which now must be perfected by the organization of new factories --i. e., by the introduction of the results of research and development on an optimum scale, and not by the verification of the decisions at head projects, as is being done in the 10th Five-Year Plan. This is a change in principle in the organization of the development of special purpose scientific-technical programs.

The program-oriented method is one of the important directions in the perfection of the planning of scientific-technical progress. It makes it possible to concentrate efforts and material means on the achievement of ultimate goals, to guarantee the comprehensive solution of assigned tasks and the continuous realization of necessary measures, to speed up the practical application of the results of scientific research and development. The program-oriented method also provides the possibility of revealing and considering the interrelationship between sectors--which is especially important in the solution of complex intersectorial problems of scientific-technical progress, which are difficult to solve within the framework of sectorial plans.

It can be stated definitively that in the decade ahead the development of scientific-technical programs will take into account the following basic directions of scientific-technical progress:

- the improvement of the national-economic, sectorial and specific structure of production, the increase of the share of machine building and metal processing in the total volume of the output of industrial production;

- the increase of the individual capacities of technological equipment to the limits which are optimal according to the technical-economic indicators, with the aim of a significant reduction of specific capital investments and material expenditures, and an increase in labor productivity;

- the expansion of export opportunities for machine building;

--the increase of the level of electrification of production and electrical equipment of labor with an economical expenditure of energy resources, the acceleration of the development of nuclear electropower engineering;

--the introduction of material-saving technological processes and the reconstruction of the production apparatus of the country in the direction of the utmost economy of raw material resources with the aim of eliminating their deficit;

--the acceleration of technological processes, the broader application of highly-effective catalytic reactions in production; the realization of open basic research of new methods of introducing processes, including in extreme and near-extreme conditions, and also processes taking place under the influence of high energy;

--the reduction of the length of the production cycle and the number of phases of the production process by means of essential changes in the methods of production, the transition to low-operation types of technology, to the perfection of the different technological operations in one plant;

--the chemicalization of the national economy, the acceleration of the output and wide use of chemical materials in all sectors of production;

--the sharp reduction of the share of manual work, the replacement of harmful and heavy work by machine work;

--the introduction of technological processes which guarantee the continuous renovation of production, the increase of its technical-economic level and quality;

--the automation of the control of processes realized in accordance with assigned operating schedules and their optimization with the aid of electronic computers.

The attainment of the most significant ultimate socio-economic results from the introduction of new technology is conditioned by the planning of a system of indicators of the technical level of the production and output of products. This system contains a complex of targets with regard to such main directions as the improvement of the quality structure of the products produced, the increase in the level of the technological base of the industries or factories and the utilization of equipment, the expansion of the sphere of application of new technological processes, the rise of the level of mechanization and automation of production, and so on.

In machine tool building, for example, it is important for the improvement of the quality structure of production to change directionally the proportion between the output of equipment for the mechanical processing by

cutting and pressure in favor of the latter method, which provides the possibility of manufacturing products close to the assigned form and dimensions, and in a number of cases fully corresponding to them (little-waste and no-waste technologies). The proportions and scales of production established by the plan must guarantee the execution of the tasks with regard to the increase in the coefficient of the use of metal, which beginning with the plan for 1980 will be one of the indicators of the technical level of the machine building ministries. In the determination of the structure of production of metal-cutting equipment it is necessary to make provision in the plan for the optimal share of special and plant-integrated machine tools, with computer program control (ChPU) (including the "processing center" type), robots-manipulators, automatic and semi-automatic lines. In machine building attention must be given to the production of such machines and equipment for the implementation of in principle new technological processes, such as component rolling mills, installations for plasma-mechanical processing, new types of vibrotechnology, installations for the processing by laser beam and others, which sharply increase labor productivity.

Of great significance are indicators which characterize the expansion of the application of in principle new and progressive technological processes, and also the increase of the levels of mechanization and automation of production. At all levels of control, the introduction of the achievements of science and technology in the sphere of the technology of production is brought under control, the scales of the application of which are tied up with deliveries of equipment and other resources for these purposes. Thus, in ferrous metallurgy the following indicators have been introduced: indicators of progressive types of extraction of ferrous ore (by the open mining method with the use of cycle-conveyer technology, the underground method with the use of self-propelled machines and vibration technology); indicators of the volume of the introduction of efficient technology for steel smelting (smelting in conveyers with a capacity of 300 and more tons and casting by continuous method). In non-ferrous metallurgy an indicator has been introduced for the development of deposits of non-ferrous metals by open mining method with the use of powerful water-filled and granulated explosive substances and with the complex mechanization of the process of charging wells, and so on.

The decree on the perfection of the economic mechanism makes it incumbent upon the USSR State Committee for Science and Technology to produce, in 1979-1980, jointly with the ministries, an assessment of technical means produced for production purposes, and to take measures to improve the technical-economic indicators of manufactured and newly-developed products as well as of the removal of obsolete technology from production. Later on such assessment must be produced systematically. Mandatory extra-departmental examination of technical-economic indicators of especially important types of production being put out and technological processes is being introduced, beginning with the technical targets and concluding

with an assessment in production (certification). Head organizations are being determined for state tests of the most important types of production for production-technical and cultural-everyday purposes. All of this will promote an increase of the technical-economic level of new developments and the objectivity of the assessments.

The decree determined the introduction of single bonuses for scientific-production and production associations (enterprises) for the development, assimilation and mass output of especially important and highly-effective types of equipment and machines, and also for the creation and assimilation of in principle new technological processes. This and other measures of a stimulation character are expanding the possibilities for the manifestation of creative initiative of the creators of technology.

Envisaged in the next 2-3 years is the completion of the formation of production associations as a basic link of industry--which, in connection with the great possibilities of large economic units for the specialization and cooperation of production and the allotting of the required resources, guarantees rapid rates of technical reequipment. In such complexes the organizational merging of science and production is realized most fully. The experience of the large production associations (the Ural Heavy Machinery Plant im. Sergo Ordzhonikidze, the Moscow Automobile Plant im. I. A. Likhachev, the Kirov Plant, the Leningrad Optical-Mechanical Association, thrice-decorated with the Order of Lenin (LOMO), and others) shows that they successfully solve the problems of the scientific-technical and organizational development of production. As a rule, in such associations there are complex scientific research, planning and design, and technological organizations which, using modern equipment, means of automation, instruments and computer technology, can guarantee the conduct of necessary experiments and tests, the finishing of products and technological processes in industrial conditions. This reduces the time periods for the development and assimilation of new products and processes and lowers the cost of operations.

The formation of funds for economic stimulation is made dependent, above all, on the quality indicators of work. With a significant increase in the output of new highly-effective products (above all products of the highest quality category) increased norms for the formation of funds of economic stimulation are being established.

An important plan lever for the maximum utilization of the achievements of science and technology is the possibility of introducing changes in the annual plans of the production associations (enterprises) in cases when, in comparison with the approved plan, there is a reduction in the total quantity of products turned out in connection with the assimilation and increase of the output of highly-effective products for production and technical purposes or new articles of high quality for the population. In so doing, the production associations (enterprises) must in good time

refine the economic contracts with clients.

Planning and economic organs have begun to realize a number of proposals of the decree of the CPSU Central Committee and the USSR Council of Ministers, which relate to indicators of the introduction of new technology.

In conformity with the decisions of the government, a complex of targets is envisaged with regard to the realization of programs of the construction of high-pressure trunk gas pipelines, the organization of production of highly-filled polymers, electronic accelerators, and others. The USSR State Planning Commission, the State Committee for Science and Technology, and the USSR Academy of Sciences have approved programs with regard to the introduction of plasma-mechanical processing methods and new types of vibotechnology. A number of new indicators of the technical level of production and products turned out is envisaged.

There is no doubt that the decree of the CPSU Central Committee and the USSR Council of Ministers is a powerful impulse for the acceleration of the rates of scientific-technical progress--the most important lever for increasing the efficiency of production and the quality of work under conditions of developed socialism.

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RELATIONSHIP BETWEEN SCIENCE, PRODUCTION EXAMINED

Novosibirsk EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA (EKO)
in Russian No 11, Nov 79 pp 21-33

[Article by Candidate of Economic Sciences L. S. Glyazer, Moscow: "Science and Production: Stages in the Formation of a System"]

[Text] The introduction of the results of scientific research into the practice of socialist production is a problem which has a long history and which has become particularly pressing in the last years. At the 24th CPSU Congress it was pointed out that the introduction of scientific and technical achievements remains the weak link of the economic connection between science and production. Since that time significant efforts have been undertaken in that sphere. Thus, while in the course of the 8th Five-Year Plan 1,700 types of new output were put into production and 500 obsolete types were withdrawn from production, in the 9th Five-Year Plan the corresponding figures came to 3,300 and 1,500 respectively, and in the elapsed period of the 10th Five-Year Plan (1976-1978) to 3,400 and 1,800.

These achievements do not yet signify the solution of the introduction problem. For instance, we have not managed to "break" the declining trend in the creation of models of new technology: in the Seventh Five-Year Plan period 4,700 models were on the average developed each year, in the Eighth 4,300, in the Ninth 4,000 and in the 10th Five-Year Plan 3,600 models per year. The technical level of new articles leaves much to be desired. An investigation of approximately 4,000 models of new technology put out in 1976 showed that only 20 percent of them exceeded the world or national levels and 60 percent corresponded to these levels. A summary evaluation was given in the Accounting Report of the CPSU Central Committee to the 25th Congress of the party. "There still are types of output," said Comrade L. I. Brezhnev, "which in the reports figure as 'new,' but which in fact are new only with respect to their date of production, not with respect to the technological level."¹ The introduction of the results of scientific research remains a problem, the solution of which still requires a large amount of work.

Resistance to the New—Bad or Good?

The term "introduction" (vnedreniye) evokes objections from many economists and organizers of science. Here, for instance, is the opinion of Academician P. L. Kapitsa: "We speak of the 'introduction' of new technology,' the 'introduction' of the achievements of science.' In the Russian language the word "introduction" signifies that the advance proceeds against the resistance of the environment. We have become so much accustomed to it that each new scientific and technical achievement meets with resistance at the time of its assimilation [into the production process] that already long ago we have adopted the term "introduction" without noting that by this word we characterize abnormal conditions in the assimilation of new technology."² It is thought that it would be more appropriate to use such concepts as "assimilation" (osvoyeniye) or "implementation" (realizatsiya) of scientific achievements, with the idea in mind of processes that run their course relatively calmly and do not require any struggle with opposing notions and prejudices, which do not need to overcome the resistance of the environment.

Nonetheless, however we change the terminology, the essence of the problem remains the same: new solutions for practical tasks found by science will run into opposition which as a rule is the stronger, the more significant is the transformation of current reality in result of these solutions. Hence it does not appear reasonable to renounce the term "introduction" which quite accurately characterizes the processes taking place in the ultimate links of the economic chain "science--production."

Resistance of production practice to the introduction of the results of scientific research is within certain limits an objectively indispensable process. Attempts to eliminate it can have no other consequences than those which arise in cases of voluntaristic resistance to the operation of economic laws. Viewed from this vantage point, the process of introduction protects production against short-fused, insufficiently substantiated projects and impedes the implementation of such scientific solutions which (contrary to the good intentions of their authors) may lead to undesirable consequences.

The well-known cardiologist Ye. Chazov, for instance, notes that in medical science there is a significant proportion of incorrect and harmful conclusions. However, the scientist points out, "these faulty scientific results would not be dangerous if they were not picked up widely, rapidly and uncritically."³ An analogous argument is adduced by Dr of Technical Sciences L. Volchkevich: "In technology policy it is pernicious both to delay the development of initial ideas and mindlessly to rush off the press insufficiently matured solutions. It is precisely this which explains the production of some models of computer operated machine tools, the productivity of which is only 40-60 percent higher than that of ordinary equipment even though they cost almost 10 times more; it is this reason which caused the introduction of manipulators costing tens of thousands of rubles to replace about 0.5 workers per shift."⁴ It is clear

that the elimination of the word "introduction" [vnedrenye] from the language and the unconditional liquidation of in fact all types and forms of resistance on the part of practice to the implementation of all results of science whatever are impossible.

The issue of introduction has long been considered a purely organizational question only. The matter was posed in these terms: Who should be responsible for the introduction of scientific-technical achievements--science or production? On whom should this "burden" be laid--on scientific workers or on the workers of the enterprises? Today it is hardly justifiable to pose the issue in these terms. In the USSR Constitution the introduction of inventions and results of scientific research into practice has been declared an all-state task.

Three Stages of Social Division of Scientific Labor

In a number of works in the field of political economy the proposition has been argued that the current view which segregates sciences into an independent branch of social production in essence reflects the regular large-scale social division of labor.⁵ The process of forming new large sectors in the national economy has definite regularities. The most important of these is the intensification of the division of labor within these sectors themselves. The detachment and development of a large sector is always preceded by a series of successive stages of intrasectoral division of labor, in result of which new subsectors are formed. Science as a large branch of social production does not constitute an exception.

The social division of labor within the sphere of science is one of the basic driving forces in the development of the modern system of the production of scientific knowledge. In the initial stages of the development of the system, the development of new knowledge and the determination of the possibilities for its practical application were functions of one and the same person. Correspondingly the work in science also was not specialized. Only in the middle of the 19th century, with the appearance of the technical sciences with a distinctly practical orientation, did the first social division of labor in the sciences take place--a relatively clear-cut separation between "pure" (basic) and applied research. It was in this connection that the famous English naturalist Thomas Huxley wrote in 1880: "The term 'applied science' ... presumes that there exists scientific knowledge which is applied directly in practice and which can be studied separately from the other kind of scientific knowledge that has no practical applications and is called pure science."⁶

Any kind of social division of labor, regardless of whether it takes place at the scale of the entire national economy or in its individual sectors, causes a substantial redistribution of the labor force and, in intensifying the specialization of the workers, leads to a sharp increase in their productivity. While statistics have not preserved evidence on the number of scientists in the 19th century, data are available on the stormy growth

in the output of science. If at the beginning of the 19th century the number of scientific journals did not exceed 100 in the entire world, it approached 1,000 towards the middle of the century and reached 10,000 by its end. As a result of the first social division of labor in the field of science the period of implementation of scientific achievements did not exceed the life time of one generation of scientists--30 to 50 years. A change occurred also in the social position of the workers of science: research activity became a profession which was paid like hired labor.

In the first decade of the 20th century the second social division of labor in the field of science came about: a special type of activity--project and experimental design work--detached itself from applied research. New types of scientific organizations appeared and spread widely: project-development and project-technological institutes, design offices, testing-experimental enterprises and others. In these organizations such scientific workers were concentrated who themselves conducted almost no research, but who were basically engaged in the materialization of the results of scientific research in production practice. The second social division of labor in science resulted in the next reduction in the implementation lag for scientific ideas (which in the 1950s came to 8-12 years) and in a new sharp increase in the number of scientific periodicals (which at the same period reached almost 100,000). An important consequence of the second social division of labor in the sphere of science was a further differentiation of scientific activity. Groups of scientific workers fulfilling specific functions attained separate identity: research theoreticians and experimenters, applied researchers, creative workers of project-planning and design organizations (developers), science-information workers, organizers of science.

The second social division of labor in the field of science gave rise to the segregation of the research and non-research functions of scientific activity. A characteristic of our time is the faster growth of non-research functions in comparison to research functions. This is above all connected with the necessity of satisfying the rapidly growing requirements of the national economy for the output of science. Such output--research results, new scientific knowledge--must be transformed and adapted in order to be utilized in the various sectors of material production, in health care, education, administration etc. This kind of transformation of scientific output is primarily the job of planning institutes, design offices and others of a similar kind.

Data on the level of development of the science sphere in the first half of the 20th century testify to the significant predominance of the non-research functions of scientific activity. Thus in the 1950s the number of scientific workers performing research was one quarter of the number of developers, and while 10 percent of those engaged in science (in an example taken from radio-electronics) were creators of new ideas, 20 percent possessed a feeling for the new, and 70 percent were engaged in the repetition of results obtained earlier. The same conclusion follows from data

on the structure of expenditures on the development of science: the outlays on research are one-tenth of those on development.

The second social division of labor in the sphere of science is already almost completed at the present time. Ever more clearly the outlines are becoming evident of processes which can be characterized as the initial stage of the third social division of labor in science. A new, independent stage of scientific activity is being formed: that of the introduction of the results of scientific research into social practice. This stage includes several operations that previously were executed within the framework of planning and experimental-design development, as well as a part of such spheres as culture, education, and a number of functions of material production. The detachment of this stage is connected with the acceleration of the progress of science and technology. Research results which are not assimilated within definite and systematically shortened time periods turn out to be obsolete by the time of their first application and the expenditures on their creation are not recovered. Hence the shortening of the introduction time of scientific research results constitutes an extraordinarily important task in our time. The level of social production depends to a large extent on how correctly and operationally this problem is solved.

New Relations--New Forms of Organization

For the moment such solutions are sought primarily in the field of the organizational form of links between science and production. These links are implemented by means of organizations which, irrespective of their great variety, can be divided into two types. Technology-introducing firms [vnedrencheskiye firmy] specialize in the introduction of the research results of scientific institutions into the practice of the work of production enterprises. They appear as independent organizational elements which implement the functions of the last stage in the "science--production" cycle. Integrated associations execute the functions of all phases of this cycle to one degree or another. These units are oriented not only to the acceleration of the last phase of the process of scientific activity, but to the shortening of all phases of this process--from the initiation and validation of the scientific idea to its practical implementation.

The first technology-introducing firm in the USSR was the "Ustanovka" Trust organized in the 1920s at the Central Labor Institute by the famous scientist A. K. Gastevo. The firm assisted in the introduction of new technology and advanced methods of production at the new industrial sites and also instructed the workers in the new professions. In the literature it is stated that "the 'Ustanovka' Trust did not and does not have a peer in this enormous and creative volume of introduction work which it fulfilled."⁹ Introductory functions were executed in the 1930s also by "Orgmetall," "Orgtekstil" and other establishments which rendered practical help to enterprises in the organization of their work, something that had special significance under the conditions of the first five-year plans.

Technology-introducing firms were established also in our days. For instance, at the beginning of the 1960s "Orgtekhstroy" trusts were organized in each territorial main administration for construction which were charged with the introduction of scientific and engineering achievements in the projects of their own main administration. However, information difficulties forced the workers of these trusts to solve many research questions by their own efforts, and this in turn provoked conflicts between "in-house" and "outside" elaborations and ultimately lead to a lengthening of the introduction periods for new technology in the branch.

The most interesting type of technology-introducing organizations, which was developed in the 1960s, were the cost-accounting firms "Fakel" [Torch], "Iskra" [Spark] and others. They operated under the auspices of social organizations (trade unions, VOIR [All-Union Society of Inventors and Efficiency Experts], NTO [Scientific and Technical Organization] and the like) and utilized the labor of non-staff specialists. These firms managed to a certain degree to overcome the obstacles which the branch (departmental) structure of production management and the lack of flexibility of centralized planning puts in the way of scientific-technical progress. The effectiveness of such firms was very high. However, on the initiative of the financial organs the majority of technology-introducing firms of this type ceased operating.¹⁰ At present technology-introducing organizations no longer have a wide distribution. Their number, as is pointed out in the literature, "is exceedingly insignificant and the majority of them is small and disposes of an insufficient scientific and technical potential."¹¹

There is still another group of organizations working on the entire complex of problems of the science-production cycle: the science-production associations (NPO). These appeared at the end of the 1960s, and already 5 to 7 years later, at the beginning of 1976, there were more than 100 of them. Projects for the organizational tables of some 20 ministries contemplate an increase in the number of NPOs to 250. The foremost NPOs and other integrated associations can shorten the assimilation period for the results of scientific research and raise the scientific-technological level of output.

The experience of integrated associations is not yet large enough to permit the drawing of convincing conclusions about their suitability for solving the problem of the introduction of scientific research results into production practice. Nonetheless, some generalizations can probably already be made. For instance, it is clear that the organizational symbiosis of science and production in such associations should in no case be permitted to "squeeze" the research activities, to give priority to the solution of current production tasks at the expense of long-term scientific problems. Facts have already come to light, however, which indicate that this unconditional principle is being violated.

Thus, some of the first integrated associations were "double subordination" organizations in the Novosibirsk science center. The scheme for these

units was the following: Science (an institute) provides the idea, scientific personnel and land for the creation of an organization, and production (a ministry) builds the necessary structures on this land and provides equipment and people for servicing it; thereafter the two partners in the organization carry the scientific idea to its embodiment "in metal" and hand it over to production. Such a scheme, it was assumed, ensures introduction at the maximum speed. In practice, however, matters went differently in a number of cases. As Academician M. A. Lavrent'yev writes à propos of this: "Some ministries gladly 'settled' on our land, but then swamped their NIIs [scientific research institutes] and KBs [design bureaus] with current tasks and the powerful computers with current accounting assignments. For innovation they now have neither the resources nor the funds."¹²

Later on the Statute on Science-Production Associations was approved which set up new procedures excluding such phenomena. "After new equipment has been made operational and a new technological process has been introduced into production, the association transfers it to production associations (combines) and enterprises, together with full technical documentation and technological fittings for mass and series production, and discontinues the production of the new equipment in the association," is stated in para. 69 of the Statute.¹³ But adherence to this procedure is the exception in practice rather than the rule. Data from one of the most recent investigations of this problem testify to this fact: In the NPO "Istochnik" [Source] the share of large series production constitutes 97.6 percent of total output, while orders from the institute make up only 1 percent.¹⁴

On the Future of the "Science--Production" System

"For the achievement of progress one must set targets which are somewhat higher than those that can be reached at present" (Max Planck).

It has already been noted that from the first half of the 20th century growth in the non-research functions of science tended to outpace that in the research functions. In the 1950s the relation between the staff employed in the execution of the corresponding functions was 1:4, but in the 1970s it reached a ratio of 1:19. If this tendency continues, the end of the 20th century will see for each worker producing new scientific knowledge 100 scientists who are not creating such knowledge but are bringing it into a form suitable for consumption. It can be said that if in the past the practical introduction of scientific ideas was a second-order task in comparison to their development, today the former is no less important than the latter and in the future it may become a more important task than the "mining" of new scientific knowledge.

Basic and applied science are so interwoven organizationally that their quantitative characteristics can be separately investigated only in the most approximate manner. However, until now there was no special need for

more precise evaluations. As long as the basic obstacles along the path of movement of the scientific idea from its conception to its practical materialization are concentrated at the final stage, the earlier stages do not require a precise determination: it has no particular significance at which one of them the work is more poorly organized as long as the total volume of losses at the initial stages is insignificant in comparison to the outlays at the final stage, that of the introduction of research results into production practice.

In the next few years, to all appearances, the receipt of precise evaluations of the labor, material and financial resources directed to the development of both basic and applied science will be on the agenda. In the same period significant efforts will have to be undertaken for the organizational restructuring of applied science. At the moment it follows to the largest part the branch principle, i.e., science solves the tasks set for ministries and departments to which its institutions are subordinated. In this respect the organization of science differs fundamentally from that of other sectors of social production. If the coal industry, say, were structured on this basis, then each ministry would have its own mines; a similar organization of light industry would mean that each branch would itself produce the clothing and shoes for its own workers.

The specific organizational principles of applied science give rise to consequences which are not the most beneficial. Thus, the management of sectors of the national economy is not always in a position to evaluate scientific results properly. In this context K. A. Yefimov, division chief in the USSR Gosplan, noted that the assessment of the level of research and development work by ministries and departments is not always objective and that this lowers the level of demands imposed on the scientific establishments of the sector and leads to serious losses for the national economy.¹⁵ The president of the USSR Academy of Sciences, Academician A. P. Aleksandrov, writes about shortcomings in the organization of contemporary science. He considers that "it is necessary to put greater efforts and energy into the improvement of the organization of scientific work, to eliminate the still existing departmental 'property rights' in the field of science, the competition of departmental scientific organizations which leads to a scattering of resources."¹⁶

The complicated structure of the field of scientific activity not infrequently results in discords between basic and applied science which are linked to the different administrative affiliations of the two spheres. Applied science research institutes, which to the largest part are subordinated to the industrial management organs, as a rule are not--and simply cannot be--interested in determining the directions of practical application of the basic research results obtained in the academic establishments. In the end, on the one hand the scientists engaged in basic research do not always transfer their results to applied science but rather attempt to bring them to practical implementation themselves, and on the other hand applied science institutes in need of basic ideas and

research attempt to develop them by means of their own efforts: "It may not be so hot, but it is our own."

It is becoming obvious that with a declining share of material and human resources directed to the development of the research functions of science its organizational division into two parts—basic and applied science—is losing meaning and cannot be utilized as one of the foundations for the management of scientific activity. In order that the research functions of science can be developed in sufficient plenitude, they should be planned, financed and provided with material resources from a single center. In this connection the need for the creation of a centralized organization for the management of research activities has matured. Such an organization will put an end to the multiplicity of managerial lines of command which today exerts an adverse influence on the development of the sphere of scientific research. A new sector "Science" of the national economy will be formed, possessing its own organizational structure, personnel and institutions and producing its own output—new scientific knowledge about the laws and regularities of the surrounding world (basic knowledge) and about the ways and means of their practical utilization (applied knowledge). This sector will receive the same economic and legal status as the other sectors of the national economy.

As a matter of fact, the first to be organizationally formed should be the stage of introduction. It is necessary to analyze critically the existing forms of linkages between science and production and to prepare precise recommendations as to the possibilities of their practical utilization and as to the creation of new forms. In this context the introduction process should be developed in two directions. The first of these is the creation of the conditions for a development stage of scientific activity. Organizations charged with the introduction function must be provided with information about the needs and possibilities of the enterprises and associations which they service. Their functions should include supervision over the activity of project-planning and design organizations in order to know to what extent these organizations satisfy the needs of production and to what extent they utilize the results of research. The second direction is the introduction process itself: a decisive participation in the arrangements for the production of new output created on the basis of the results of research activity.

In its most general outlines this represents the future "science--production" system, the process of establishing which is now going forward under our eyes.

FOOTNOTES

1. "Materialy XXV s'yezda KPSS" [Materials of the 25th CPSU Congress], Moscow, Gospolitizdat, 1976, p 47.

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3. LITERATURNAYA GAZETA, 1978, No 2.
4. IZVESTIYA, 1978, 13 February.
5. Cf. Gatovskiy, L. M. "Ekonomicheskiye problemy nauchno-tekhnicheskogo progressa" [Economic Problems of Scientific-Technical Progress], Moscow, Nauka, 1971, p 119; Kamayev, V. D. "Sovremennaya nauchno-tekhnicheskaya revolyutsiya: ekonomicheskiye formy i zakonomernosti" [The Modern Scientific-Technical Revolution: Economic Forms and Regularities], Moscow, Mysl', 1972, p 70.
6. Quoted from: "Problemy razvitiya nauki v trudakh yestestvoispytateley XIX veka" [Problems of the Development of Science in the Works of the 19th Century Naturalists], Moscow, Nauka, 1973, p 203.
7. RADIOELEKTRONIKA V 1970 G., vol 10, Moscow, 1971, p 82.
8. "Effektivnost' nauchnykh issledovaniy" [The Effectiveness of Scientific Research], Moscow, Progress, 1968, p 50.
9. EKO, 1977, No 5, p 149.
10. Many economists consider the dissolution of "Fakel", "Iskra" and other technology-introducing firms a mistaken decision (cf., e.g., Volin, P. "Eksperimenty" [Experiments], Moscow, Sovetskaya Rossiya, 1973, pp 31-64; VOPROSY EKONOMIKI, 1977, No 1, p 49). One can take various attitudes to this opinion, but it is obvious that a problem of state significance such as the introduction of technology cannot be solved on a social basis in after-hour work.
11. Taksir, K. I. "Nauchno-proizvodstvennyye ob'yedineniya" [Scientific-Production Associations], Moscow, Nauka, 1977, p 24.
12. EKO, 1975, No 6, p 62.
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14. Cf. Nesvetaylov, G. A. "Nauka i yeye effektivnost'" [Science and Its Effectiveness], Minsk, Nauka i Tekhnika, 1979, p 60.
15. VOPROSY EKONOMIKI, 1979, No 4, p 78.
16. Aleksandrov, A. P. "Atomnaya energetika i nauchno-tekhnicheskii progress" [Atomic Energy Generation and Scientific-Technical Progress], Moscow, Nauka, 1978, p 70-71.

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MANAGEMENT OF PRODUCT QUALITY CONTROL

Novosibirsk EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA (EKO)
in Russian No 11, Nov 79 pp 34-49

[Article by Dr of Economic Sciences D. S. L'vov, professor at the Central Economic-Mathematical Institute, USSR Academy of Sciences, Moscow: "Reference Point: Ultimate Effectiveness"]

[Text] An important stage in the development of the system of quality management as a part of the general management system has been the adoption of the new "Basic Rules on the Certification Procedure for Output of Machine Building and Other Branches of Industry." Tougher demands on the quality of output produced were instituted, the role of the consumer was strengthened, and the control of USSR Gosstandart increased. In some branches a significant part of the products reached the level of the best world models and even exceeded it. At the same time, measures for quality improvement are not always fully implemented and the output produced by individual enterprises and even branches does still not correspond to modern requirements.

Specifics of Quality Management

When we speak of high-quality output, we have in mind such output which most fully satisfies the corresponding needs of the national economy and which in the final accounting turns out more remunerative than output of lower quality. And if we want to have overwhelmingly high-quality output from mass production, it is incumbent on us to take into account to the greatest degree possible the specific features which result from the economic nature of production quality itself. What then are these specifics?

First, the quality issue is as a rule decided at the junction of branches. The quality of final output is organically connected with the quality of technological equipment, semifabricates, materials, fuels and raw materials. Thus the problem has long ago outgrown the sectoral limits and turned into a more large-scale problem encompassing the entire economy.

Second, the quality of a product reveals itself in the process of consumption, where the superiority of new output in comparison to the old becomes

clearly evident, where the economic benefit of the substitution makes itself effectively felt. The benefit may find expression in a reduction in the specific norms for materials, fuel or electricity expenditure, in a reduction of outlays on repair and technical servicing. The outlays of the user in the operation of high quality products are reduced. This is the reason why the appropriateness of raising output quality cannot be determined without taking social requirements into account.

Third, raising the quality of output produced as a rule increases the expenditures of its producer, who obtains new materials and equipment (more expensive inputs) and expends more labor. In result the saving of expenditures on the part of the user may not cover the increase of expenditures of the producer. From the social point of view this is not at all to be approached with indifference. Quality for the sake of quality cannot be the aim of the development of production (we do not consider some special cases where quality has no alternatives--defense needs or specific types of basic research). In the majority of cases quality increases ought to produce economies in overall labor expenditures and lead to growth in the final social product. Hence the work of enterprises producing output of increased quality must be evaluated through a comparison of the expenditures and results of production, a juxtaposition of the economic benefits for the user to the increased outlays of the producer, where the former should balance the latter.

Fourth, what is important is not an evaluation of the unit of output but of the entire mass of output destined for the satisfaction of planned requirements. And in this relation the quality is inseparable from the quantity laid down in the national economic plan. Hence the following is clear: to manage output quality one must above all assess correctly its overall economic significance. For a correct orientation in the selection of the most economic directions of business conduct enterprises must have at their disposal an objective criterion for the effectiveness of their work. It is for this reason that output quality is at the present considered one of the basic indicators of the effectiveness of enterprise work.

Fifth, outlays on raising quality must be made today, whereas economies in use are not obtained immediately, but only after some time. Hence there arise conflicts between the current and the long-run plan tasks. In order to resolve these we must have a long-term national program for raising output quality calculated for 5, 10 or more years. This should be a component part of the long-run national economic plan.

It is clear that these specific features of output quality management require definite changes in the existing economic mechanism, in the system of plan indicators, in price formation, financing, economic incentives and the structure of production administration.

A Generalized Indicator of Output Quality

The scale of work on raising output quality in the sectors of the national economy is continuously expanding, and it is extremely important to intensify the demands imposed on the methods for the economic justification of project-planning decisions. The producer ought to observe the needs of the consumer directly, and not conjecturally or selectively, and ought to know precisely to what extent the output produced by him satisfies the requirements of the user. And this is why we need a generalized quality indicator in the state standardization and certification system. It would permit a judgement on the economic progressiveness of the output produced and the comparison of the work of enterprises and entire sectors.

At the present such comparisons are made on the basis of the share of output in the higher quality categories. But is it possible to determine the contribution of the enterprise collective to the raising of the final effectiveness of production on the basis of this indicator? We think that this is not the case.

How much the total effectiveness of production increased owing to an increased share of output in the higher quality categories can be determined only if the price of the higher quality output reflects the dynamics of the economic effect of the utilization of this output by the user in a manner which balances production and consumption conditions.

But a price of this type is determined on the computation methodology for the so-called upper price boundary, which presents well-known difficulties owing to insufficient availability of information. However, we have in this country a "Methodology for the Determination of the Prices for New Types of Output of Production-Technical Destination" (1974) and a "Methodology (Basic Statutes) for the Determination of the Economic Effectiveness of Utilizing New Technology, Inventions and Rationalization Proposals in the National Economy" (1977). The basic principles of the two methodologies are mutually coordinated. At their basis lies the computation of the upper price boundary (P^U) which captures the economic benefit obtained from the new product by the user.¹

The economic losses (increase in outlays), on the other hand, find expression in an increase in the lower price boundary (P^L). It is defined by the well-known formula for the annual outlays incurred:

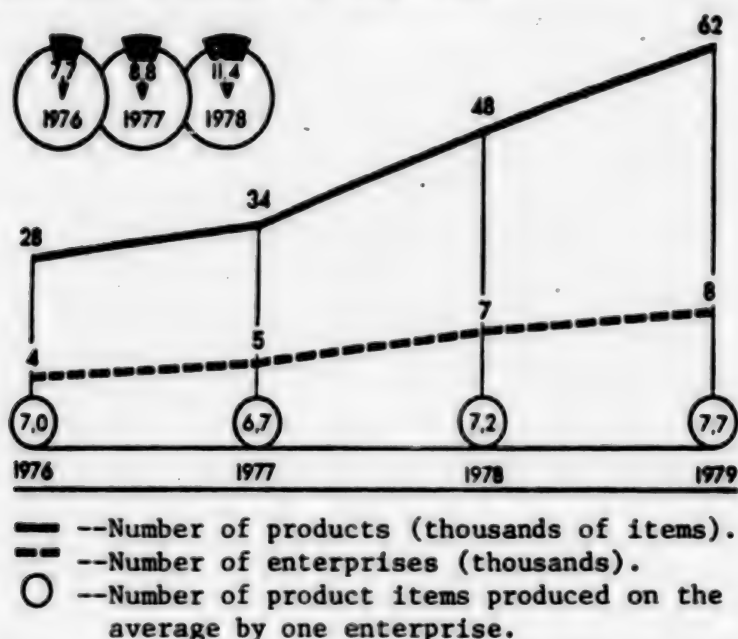
$$P^L = C^L + E^L K^L,$$

where C^L -- the production cost per unit of the new product,

E^L -- the proportional capital investment,

K^L -- the normative coefficient for the economic effectiveness of capital investment (in the new methodology its magnitude has been set equal to 0.15).

[Diagram 1.] Number of Products Holding the State Quality Emblem, and Number of Enterprises Producing These Products, 1976-1979 (Data for 1 January of Each Year)



Circles in the upper part of the diagram show the share of products of the higher quality categories in total industrial output (in percent).

Note: In 1977, Quality Emblems were cancelled for 353 product items, including 162 items of the USSR Ministry of Light Industry, 124 items of the USSR Ministry of Food Industry, and 22 items of the USSR Ministry of Electrical Equipment Industry. In 1978, the Quality Emblem was withdrawn from 409 product items, including 250 produced by the USSR Ministry of Light Industry, 47 of the USSR Ministry of Food Industry and 21 of the USSR Ministry of Electrical Equipment Industry.

Hence the assessment of the quality of output produced can be expressed in a comparison of the upper and lower price boundaries. This relationship can be adopted as the generalized indicator of output quality (K^0):

$$K^0 = \frac{P^U}{P^L}$$

The higher this coefficient, the higher is output quality and its final economic effectiveness. Naturally, a generalized quality indicator will not have a uniform significance for different users. For this reason it must be planned separately for different usage spheres of the product. For instance, for agricultural equipment these might be nature-climate zones, for universal metal-cutting tools, the basic and auxiliary shops

of machine-building plants, the repair services of metallurgical combines, and the like.

The question arises, how is the work of the enterprise to be evaluated if its output is assessed differently in dependence on the user? A correct answer can in our opinion be obtained only under conditions of the construction of an optimally balanced production and distribution plan for new output. What do the procedures for setting up such a plan consist of? For each year of the production of new output, possible usage spheres for its consumption manifest themselves, as well as the total requirements (after the deduction of those spheres which receive the new product on the basis of priority need allocations), and for the remaining users the upper price boundaries are calculated and a definite rank sequence for the satisfaction of the requirements for the new products is established. In this context preference is given to those usage spheres where the upper price boundary is the highest.

Thereafter the sphere of utilization of the new output which closes off the annual production plan is determined. This is the sphere, the requirements of which will be only partially satisfied in the given year.

Satisfaction of Requirements by Stages

Let us review the sequence of constructing a balanced production and distribution plan through the example of the development of series production of a new truck destined for utilization on different types of roads and for the transport of different types of freight. Four usage spheres have been defined in dependence on these variations, each of which is characterized by a different upper price boundary.

For each user group (usage sphere) we have computed the generalized quality indicator K^0 on the formula: $K^0 = p^U/p^L$:

$$\begin{aligned} K_1^0 &= \frac{3,500}{3,000} = 1.17; & K_2^0 &= \frac{3,000}{3,000} = 1.00; \\ K_3^0 &= \frac{5,500}{3,000} = 1.83; & K &= \frac{4,200}{3,000} = 1.40. \end{aligned}$$

The third usage sphere has the highest quality indicator, as can be seen. This indicates that the utilization of the trucks in this sphere yields the highest economic return and permits the fullest satisfaction of concrete requirements. Starting from this point, we establish the sequence of the satisfaction of requirements for the new truck by usage sphere: 3d, 4th, 1st and 2nd, which corresponds to the ordering of the effectiveness indicators of the truckers.

Table 1. Basic Production and Utilization Indicators of New Trucks
(Assumed Data)

(1) Производство			(2) Потребление			
(3) Годы выпуска	(4) Объем производства, тыс. шт.	(5) Нижний предел цены новой продукции, руб.	(6) Сферы использования	(7) Верхний предел цены, руб.	Потребность, (8) тыс. штук	
					(9) по сферам	(10) нарастающим итогом
1-й	50	3000	1-я	3500	80	80
2-й	70	3000	2-я	3000	80	160
3-й	90	3000	3-я	5500	100	260
4-й	130	3000	4-я	4200	90	350

Key:

- | | |
|-------------------------------------|----------------------------------|
| 1. Production | 6. Usage sphere |
| 2. Consumption | 7. Upper price boundary (rubles) |
| 3. Year of production | 8. Requirement (th. units) |
| 4. Volume of production (th. units) | 9. --by usage sphere |
| 5. Lower price boundary (rubles) | 10. --cumulative total |

Table 2. Production--Distribution Balance of the New Truck

(1) Сферы потребления	(2) Потребность, тыс. штук		(5) Верхний предел цены, руб.	(6) Покрытие потребности по годам производства, тыс. штук				(7) Итого
	(3) по сферам	(4) нарастающим итогом		1	2	3	4	
3-я	100	100	5500	50	50	—	—	100
4-я	90	190	4200	—	20	70	—	90
1-я	80	270	3500	—	—	20	60	80
2-я	80	350	3000	—	—	—	70	70
(8) Годовой выпуск, тыс. штук				50	70	90	130	

Key:

- | | |
|----------------------------|--|
| 1. Usage sphere | 5. Upper price boundary (rubles) |
| 2. Requirement (th. units) | 6. Coverage of requirement, by production year (th. units) |
| 3. --by usage sphere | 7. Total |
| 4. --cumulative total | 8. Annual production (th. units) |

From this it is evident: the more fully requirements are satisfied, the lower is the price level. The process of price reduction in conformity with the plan (in our example, 5,500 rubles at the first stage, and 3,000 rubles at the last stage in the 4th year of production) should, according to our opinion, also lie at the base of output quality planning in enterprises and branches of industry.

Long-Term Quality Planning

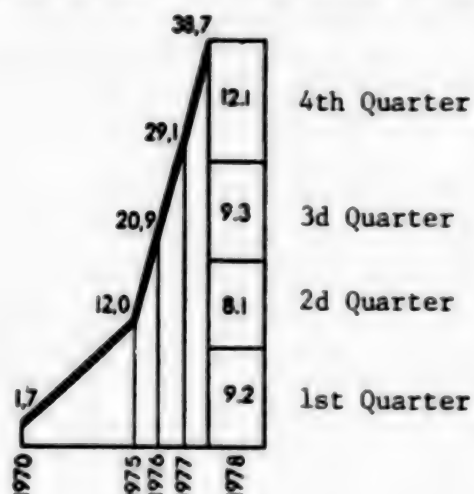
The present quality planning system is oriented to a significant degree to intermediate results. Problems of raising the technical level of each concrete article are at the present placed in the foreground. Not infrequently articles of final consumption are ignored, as is also the question of a high ultimate quality of the entire production system or of its individual subsystems or of machinery complexes.

We can set up new, highly productive and precise equipment in one sector, but if in the connected sectors we continue to work old equipment, the advantages of the new technology will not be fully utilized. What is more, its yield will be at the level of the old technology. In such cases we observe a decline in the capital-output ratio and an increase in the outlays per unit of utilizable results, and the high calculated effectiveness of new technology turns into an actual loss for the user.

For this reason one should not always and everywhere strive for the utilization of only high-quality technology. In individual cases it would be much more advantageous to utilize equipment of the first quality category in a single technological system or complex of machinery. What is important is the final result, and not high indicators for the technology employed. The "race" for novelties, pursued with indifference towards ultimate productivity, on the whole costs the state very dearly.

The striving for technological progress ought to be implemented with the application of target-programming methods in planning practice. At the base of the plan for raising the technical level and quality of output we can put complex standardization programs in which the standards for the initial types of raw and other materials, for subassembly articles and final output would be interconnected. Such attempts are being made, but what is indispensable is interbranch and intrabranh coordination of the requirements both for the production components listed and for the equipment, production preparations, and means and methods for quality control of output. The standards prepared within the framework of these programs, comprising different levels of indicators and requirements, can assure a systematic raising of output quality according to plan for a span of 10 to 15 years. Complex standardization programs appearing as component parts of complex programs for scientific-technical progress can also determine a rational degree of interchangeability for the individual parts of technological complexes, establish the requirements for parts and subassemblies with interbranch applications, and effect the creation of specialized interbranch enterprises for their production.

[Diagram 2.] Number of Products Awarded the State Quality Emblem in the Corresponding Year (thousands of items)



Note: Out of the total number of products certified for the highest quality category in 1978, 29.2 thousand items (76 percent) were mass consumption goods and 9.4 thousand items (24 percent) articles of production or technical use.

For the purpose of assuring the unity and cohesiveness of all elements of the uniform process of the creation and utilization of technological systems and complexes, it would be advisable to introduce a two-stage system of planning. The first stage comprises the development and experimental introduction of integrated technological systems and machinery complexes (from the scientific-research work to the transfer of experimental-industrial installations to the interdepartmental commission). At the second stage, the integrated technological systems are introduced into the national economy and concrete tasks for ministries and departments are determined.

After the head organization has introduced the new technological complex of machinery into effective operating conditions, the technical-economic indicators attained in operation are determined and thereafter adopted as the standard for the production of new equipment. This constitutes the initial inventory for a plan for the transfer of plants to the production of the new complexes and the placement of orders for individual machines, aggregates and subassemblies making up the complex.

The confirmation of such a plan signifies the cessation of the production of equipment whose indicators are inferior to the indicators of the standard for the production of new equipment. The indicators of the standard are considered the long-term economic normatives for the raising of quality.

This, in broad outlines, is how the overall economic level of the planning of industrial output quality presents itself to us. This system refers to the product list of the most important articles, and above all to technological systems and machinery complexes.

While the production base of the sector works on the implementation of the program established earlier, its scientific-experimental divisions already develop a new program--i.e., lay down an inventory. The object of planning here is a new integrated technological system with higher productivity and effectiveness than that presently under production in the plants of the sector.

The goals and tasks decided in the two stages of planning are separated in time. This in particular also ordains some specific features in the incentives for work performed in the first and second stages of planning. It is true that in both stages the incentive system ought to work towards the ultimate result, the raising of the final effectiveness of production, and that the assessment of results derives from the actually achieved level of effectiveness in the utilization of new technology under real conditions of operation. However, at the first stage the introduction of testing models must be stimulated, and at the second stage the scale of introduction of new output in the national economy.

It is also clear that the incentives for developers and designers of new products must aim at the attainment of the expected magnitude of economic effects as computed on the basis of the indicators of the technical-economic level of the product. Producers of new output, on the other hand, must be offered incentives not for the calculatory but for the actually achieved magnitude of the effect, as expressed in the production price and consequently in the total volume of net profit. But the net profit from the output realized at the same time also constitutes the source for advancing pre-production outlays and, in particular, is also utilized for incentive payments to the developers. In this manner all stages of the development and creation of new output can be oriented towards the achievement of high production effectiveness indicators.

The transition to the target programming method of planning calls for a definite restructuring of the system of state management of product quality. In this connection we should like to stress the role of the USSR State Committee for Standards (Gosstandart). In our opinion this committee ought not only to be the "legislator of fashions" in the field of standardization, technological level and quality of output, but also the organization which is economically responsible for their implementation in the national economy. The planned financing of integrated programs for the standardization of output and quality, the series and mass production of standardized subassemblies and components of intersectoral application--these are the future basic functions of Gosstandart. The national economy would obtain large economic benefits from a decision to this effect.

The Usage of Output and Quality

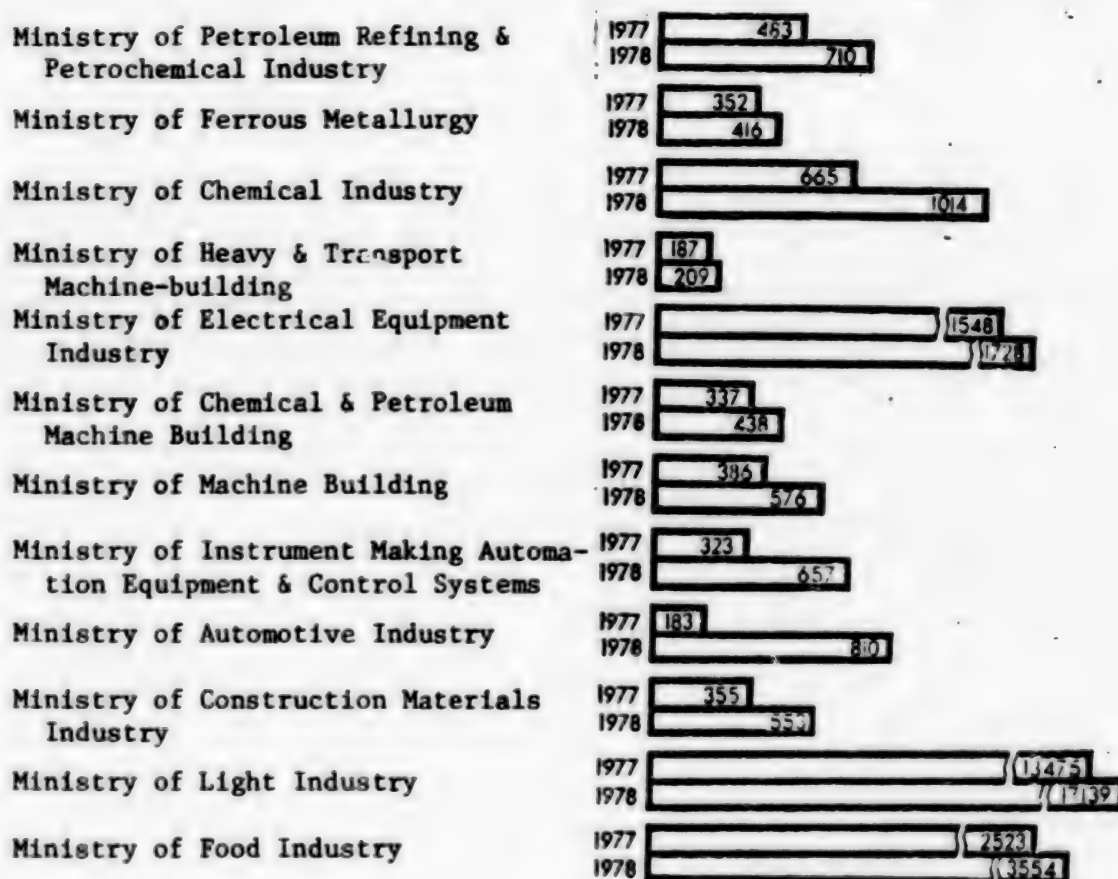
The achievements of industry in the raising of the quality, reliability and durability of output are little noted in the economy also for the reason that the organizations operating the equipment are poorly connected with its producers. This explains in many respects the low culture of operation, the premature decommissioning of equipment and the low quality and high cost of repairs. As a result the rapidity with which basic components wear out, e.g. in tractors, automobiles and other transport equipment, is higher than it would have to be under normal conditions. And when repair is being performed, too many components in good working order are replaced, owing to intuitive methods of equipment evaluation. In spite of this a significant part of the machinery and equipment is taken out of operation for pre-schedule major overhauls--a fact which applies in particular to agricultural equipment, the capital repair of which takes place in massive arrays each winter. In individual sovkhoses the capital repair plans for equipment are being overfulfilled by 150 to 200 percent. In machine-building enterprises a huge number of metal-cutting lathes goes into pre-schedule general overhauls. Phenomena of this type are provoked by contra-economic incentives: enterprises and organizations strive to put to use all monies allocated to capital repairs, or they have plan tasks specifying the number of machines put through a general overhaul.

On the other hand, the quality of overhauls carried out by the operators of equipment is exceedingly low. The engine capacity and reliability of machines declines after overhauls to one-half to two-thirds of the previous level. The labor intensity of overhauls is as a rule three to five and more times higher than the labor intensity of the production of new machines and equipment, and owing to the extremely poor level of technical equipment in overhaul operations the share of manual labor reaches 75 percent (as against one-third to one-half of that level in original production).

The actual state of and the actual losses to the national economy are often veiled by the substitution of so-called medium overhauls for the concept of the general overhaul. It is not difficult to note that within the overhaul cycle of a machine there are two medium overhauls which in essence are equal to one general overhaul. Over the last 30 years the durability of, e.g., metal-cutting lathes has formally increased 3-fold, but in actual operations this increase came to no more than 30 to 35 percent if medium overhauls are taken into account.

From what has been said the conclusion suggests itself that the transformation of the repair and overhaul sphere onto a unified industrial basis is indispensable. It is more than doubtful whether today one can assign a rationale for the unchanged practice, inherited from the past, of dividing resources between the production and the overhauling of machines. While in earlier times it was economically justified, this kind of planning practice is now obsolete. However, out of inertia the planning organs continue

[Diagram 3.] Number of Products Awarded the State Quality Emblem in Years Shown, by Individual Ministries (thousands of items)



to carry out an old policy which finds expression above all in the stabilization of plan norms for amortization deductions to capital repairs of even those types of equipment, the requirements for which are now being sufficiently fully satisfied. From 40 to 60 percent of the amortization deductions are annually being spent for these purposes. It is not rare that in the course of its planned service life a machine undergoes capital overhauling 2 to 3 times. More than 20 percent of the metal-cutting lathes working in industry had 4 capital overhauls.

The industrialization of overhauling issues from the changed conditions of machinery design and production. For the most part machines now have independent subassemblies and blocks which are joined into a single whole by means of rapidly dismountable junction structures. The overhaul of such machines takes the form of the replacement of the worn-out or decommissioned assemblies or elements, without a full dismantling of the machine as used to be the case earlier. This can also be implemented within the framework of technical servicing. From the technical point of view the concept of "capital repairs" becomes increasingly indeterminate: the borderlines between capital, medium and current repairs have been eroded.

Under the circumstances taking shape it is necessary to bring into life with consistency the principle of economic and legal responsibility of the producer for the operational reliability of his output. It is time to lay onto the shoulders of the ministries the responsibility for the qualitative technical servicing and the repair of equipment. In that case the utilization of modern industrial methods, high-quality repairs and low outlays for their execution will be possible. Producer enterprises might then know better the weak spots in the machines produced by them and eliminate these.

We have in this context the good experience of the VAZ [Volga Automobile Plant]. The head enterprise can be given the right to organize enterprise-owned stations in the various regions of the country for the technical servicing of the machines produced. The source providing the funds for the creation of such stations can be a part of the profits from the sale of the output of basic and repair enterprises organized in a single association.

The time has become ripe for checking the proposals for the improvement of capital repair financing in an experimental procedure. In particular, such proposals as the charging of all repair outlays directly to the current expenditures of sectors with sufficiently developed systems of preventive maintenance, the formation of special repair funds in enterprises of the oil refining, metallurgical and other industries, the transfer of the amortization deductions for capital repairs into the development fund, and others, could be the subject of analysis and experiments.

It is obvious that there is also a need for review of the organization of warranty repairs. At the moment the outlays on this are included in production costs and then transferred to the consumer service organizations for warranty obligations. This gives rise to a paradoxical situation: the fewer repairs there are, the worse [the service]. Quality improvement, for instance in household equipment, today is in conflict with the entire system of obligations of the domestic service organizations engaged in its repair. Naturally this situation also does not provide incentives for the producers to strive for improvements in the quality of refrigerators, vacuum cleaners, sewing machines and the like. At the same time every breakdown of household equipment deprives its owner of the possibility of utilizing it, reduces the level of comfort and leads to a loss of time and resources. What then can provide a warranty to the individual user of household equipment? Pre-paid repairs is the answer. Clearly it would serve as a more reliable warranty if producer enterprises were obliged to replace immediately and without charge inoperative components or the entire machine and to debit the outlays to their own account, charging them against the financial results of their operations. The inclusion of warranty charges in production cost, which is so popular at present, is from the economic point of view admissible only for the assimilation period of a new product and thereafter ought to be replaced by coverage of these charges from the additional profits during the series production period.

Integrated systems of output and work quality management, which are becoming widely applied in enterprises, undoubtedly are yielding a definite return and are exercising a positive influence on the entire life cycle of products. And this effect naturally increases as these systems spread to entire sectors. What is needed, however, is an overall solution for the problem of raising quality in the entire national economy and an all-sided stock-taking of the economic specifics of output quality. An objective assessment of the return obtained from high-quality products, a stock-taking of the long-term tasks in planning their production and operation, a restructuring of the system of linkages between producers and users--these are the basic elements guaranteeing a high overall economic effectiveness of all the work on raising the quality of industrial output.

FOOTNOTE

1. Cf. formula 4 in "Metodika (Osnovnyye polozheniya) opredeleniya ekonomicheskoy effektivnosti ispol'zovaniya v narodnom khozyaystve novoy tekhniki, izobreteniy i ratsionalizatorskikh predlozheniy" [Methodology (Basic Statutes) for the Determination of the Economic Effectiveness of Utilizing New Technology, Inventions and Rationalization Proposals in the National Economy], Moscow, Ekonomika, 1978.

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STIMULATION OF NEW EQUIPMENT DISCUSSED

Moscow PLANOVOYE KHOZYAYSTVO in Russian No 12, Dec 79 pp 17-26

[Article by V. Astaf'yev, Administration Chief at the Ministry of Electrical Engineering Industry, A. Kas'yanov, Division Chief at the Ministry of Electrical Engineering Industry, and V. Khaykin, Professor at the Khar'kov Engineering and Economic Institute: "Stimulating the Development and Introduction of New Equipment"]

[Text] The electrical engineering industry is one of the branches which is successfully accomplishing the tasks of increasing production efficiency. Since 1969 an economic experiment has been carried out here which is connected with the development and realization of measures to improve the management of scientific and technological progress. The system of planning, financing, and economically stimulating the creation and introduction of new equipment which is employed at the enterprises and associations of the Ministry of Electrical Engineering Industry is now being spread to other branches of industry.

The management of the process of improving the technical and economic level and quality of output is performed in the branch on the basis of a planned increase in the production of highest quality category output (which corresponds to the best world achievements or surpasses them) and a decrease in the proportion of second quality category output (which does not meet the requirements of the economy and is subject to removal from production or to modernization). In addition, the proportion of highest quality category output is one of the basic indicators for evaluating the production work of a branch as a whole and of each individual enterprise.

In keeping with the five-year plan, the annual assignments of an enterprise (association) include: the indicators of the shares of highest and second quality category output with a breakdown by quarters; the products list of new products which are to be mastered and produced in the planning year; the assignments for the products lists (list) of second quality category products which are subject to removal from

production or to modernization, with the specification of schedules; the indicators of annual economic effect from the introduction of measures to improve production, working conditions, and management; and the indicators of the national economic effect which is obtained by the consumer from the use of highest quality category products.

The special feature of planning new equipment in the electrical engineering industry consists of its continuousness. Planning embraces the work from scientific research to the creation and mastery of new products, that is, the entire "research production" cycle. Continuous planning is based on intra-ministry schedule orders which have the force of economic contracts. The schedule order includes all of the stages of the work and it specifies the topics and executors and also the sources of financing. There are two such sources -- the single scientific and technical development fund which is formed from planned profits, and the resources of clients. The part of the single scientific and technical development fund which is not utilized in the current year is not subject to removal and is expended for the financing of technological progress measures in the following year. In order to open a schedule order it is mandatory to perform and approve a technical and economic substantiation of the expediency of developing a new equipment plan.

This system of planning and stimulating technological progress provides for incentive markups and discounts on wholesale prices in relation to the quality of new equipment and for economic stimulation funds in relation to its effectiveness. There are three such funds -- the material incentives fund, the social and cultural measures and housing construction fund, and the development fund for the organizations participating in the creation of the new equipment. The resources for them are allotted by enterprises in measure with the introduction of the corresponding measures and are assigned: to the centralized fund of the ministry (20 percent), to the design, scientific, and other organizations participating in the development of the new equipment (in the shares established for them), and to their own bonus fund for new equipment. Scientific, planning and designing, and production planning organizations assign 60 percent of the monies they have received to the incentives fund and 40 percent to the social and cultural measures and housing construction fund. The organization development fund which is formed from special sources is used to purchase equipment, instruments, and materials for scientific research work and for capital investments to expand the production base of the organization.

As a result of the realization of these measures the basic indicators of scientific and technological progress have improved. The real economic effect from new equipment has increased, the number of new highly progressive products have increased and the time connected with developing and introducing them has decreased.

During the last ten years there has been a substantial rise in the technical level of the branch's output. Whereas in 1968 the proportion of highest quality category output came to only slightly more than 7.5 percent of total production, in 1978 it was 42.7 percent (compared to 11.4 percent in the industry of the USSR as a whole). The average annual rate of its growth reached 36.4 percent, while that of all of commodity (gross) output was 8 percent. There has been a corresponding decrease in the production of second quality category output whose proportion of the total volume of production came to 17.1 percent in 1968 and in 1978 to 1.2 percent.

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During the past decade the enterprises and associations of the Ministry of Electrical Engineering Industry have mastered more than 14,000 new highly effective products and have removed from production around 5,000 obsolete machines and apparatuses. The branches of the economy which consume the output of electrical engineering have economized 6 billion rubles. The national economic effect per ruble of expenditures for scientific research and experimental designing work increased to 2.4 times, per ruble of the cost of new output -- 3.7 times, and per ruble of the single scientific and technical development fund -- 2.2 times. Labor productivity in the branch increased by 1.9 times, and its average annual growth rate came to 6.3 percent, which is approximately 1.5 times greater than the analogous indicators in industry as a whole. The economic stimulation funds for new equipment increased by 2.9 times, and their share of the total national economic effect decreased, which corresponds to the requirements of the principle of an outstripping growth for production efficiency over an increase in the incentives for achieving it.

Meanwhile, the practice of planning and evaluating production work which developed as a result of the experiment proved to be insufficiently coordinated with the system of planning and stimulating the development of new equipment. Not all of the necessary conditions were created for strengthening the interest of enterprises in speeding up scientific and technological progress and improving output quality. The production of new products which were highly effective for the economy frequently led to a worsening of the evaluation indicators of enterprises: the amount of production, labor productivity, and profits. To a substantial extent this was a result of the fact that the planning and evaluation of the volume of output production and of labor productivity was performed, as in other branches of industry, without consideration to the changes in the quality and technical level of output and the national economic effectiveness of new products. Since the specific labor intensiveness of new products is in most cases higher and their profitability lower than those which have long been mastered, their production leads, as a rule, to a decrease in the volume of output production by value, a fall in output, and so forth, or to a slowing down of the growth rates of their

indicators, which in the final analysis has a negative effect upon the cost accounting stimulation funds of associations and enterprises. The economic stimulation funds for the creation and introduction of new equipment are approximately 10 times smaller than the material incentives funds for the basic results of economic work; for this reason, enterprises are not capable of covering losses in their cost accounting stimulation funds when they shift to new types of output.

In order to eliminate these and other shortcomings and to further increase production efficiency in the branch, new conditions of planning and economic stimulation have been worked out and were introduced in 1979. Their chief characteristics consist in the following:

there is a change in the system of directive planning and evaluation indicators of the work of the ministry and of its all-union industrial and production associations and enterprises;

the five-year plans become the basic form of planning in the branch;

stable economic long-effect norms are established which makes it possible to do away with the practice of planning from an achieved base and to make more efficient use of production reserves;

the system of planning indicators and the long-term norms are subordinated to the tasks of increasing production intensification, accelerating scientific and technological progress, improving output quality and labor productivity, and achieving high final economic results;

economic methods are being developed for managing the branch -- from the production association (enterprise) to the ministry as a whole;

the material responsibility of enterprises for fulfilling contract commitments for output deliveries is being increased;

the dependence of wages and bonuses upon the quality of work and upon production efficiency is being strengthened;

the role of economic levers -- profits, price, finance, and credit -- is being increased.

In order to plan and evaluate production amounts a new procedure is being introduced for determining the growth rates of the value indicator on the basis of a recalculation of the amount of the commodity output of the base year with a coefficient which takes account of the effectiveness of new output compared to the output being replaced (the amount of commodity output in comparable prices).

The index of the amount of production is determined according to the formula:

$$T = \frac{O}{O_0 - \sum E_i K_j B_i}$$

Where

- T -- is the growth rate (index) of production volume in a given (planning or reporting) year compared with the base year;
- O -- is the amount of commodity output in the given year;
- O₀ -- is the amount of the commodity output of the base year in the methodology of the given year;
- E_i -- is the economic effect from the production and use of a unit of i-new product of the highest quality category;
- D_i -- is the production of a highest quality category product in the given year;
- K_j -- is the coefficient which takes account of the share of economic effect when the growth rate is calculated for a given (j) group of products.

The procedure for performing the calculations is reflected in Table 1.

Table 1.

Таблица 1

1. Изделие	2. Цена, тыс. руб.	3. Эффект Э, тыс. руб.	4. Коэффициент К	5. Базисный год		8. Денный год		
				6. выпуск В, шт.	7. объем произукции, тыс. руб.	6. выпуск В, шт.	7. объем произукции, тыс. руб.	9. ЭКВ, тыс. руб.
А	10	-	-	2 000	20 000	1 000	10 000	-
Б	200	-	-	500	100 000	350	70 000	-
В	150	55	0,5	-	-	200	30 000	5 500
Г	40	30	0,4	-	-	125	5 000	1 500
Итого	-	-	-	-	120 000	-	115 000	7 000

[Key on following page]

Key:

- | | |
|-----------------------------------|---|
| 1. Product; | 6. Production B, units; |
| 2. Price, thousands of rubles; | 7. Amount of output, thousands of rubles; |
| 3. Effect E, thousands of rubles; | 8. Given year; |
| 4. Coefficient C; | 9. ECB, thousands of rubles; |
| 5. Base Year; | 10. Total. |

It can be seen from the table that during the base year the enterprise produced products A and B, and in the given year, curtailing their production, began at the same time to produce the highly effective products C and D. As a result, the value of the total amount of commodity output decreased by 5 million rubles, while the index of the amount came to .96, or 96 percent ($T = \frac{115}{120}$). But when the growth rates of the

value indicator with the economic effect of new products taken into account is determined in accordance with the above-cited formula, the result turns out to be equal to 1.02, or 102 percent ($T = \frac{115}{120 - 7}$).

Moreover, the greater the effect from the production and consumption of each new product, the smaller the denominator of the formula, and, consequently the higher the growth rates in comparable prices of the volume indicator and of the growth rates of labor productivity, the wage fund, and so forth which are connected with it.

As we see, the calculation of the new indicator is not difficult and, at the same time, it is based on the present system of price setting for new products, since the national economic effect from the production and use of new products (Ei) is mandatorily calculated when a price is set. The amount of effect which is used in determining growth rates characterizes the real income of society which is received by it as a result of a shift to the production of new equipment. In addition, settlements with the consumer are carried out according to the prices in effect and include incentive markups for output quality.

The basic advantage of the indicator of the amount of production in comparable prices is that, on the one hand, it creates the conditions for strengthening the economic interest of enterprises in mastering new types of products, since the deduction of the amount of the effect from the base amount of commodity output compensates for losses in amounts of production, labor productivity, and in the wage fund; on the other hand, when it fails to fulfill a plan for the production of new products an enterprise will find itself among those who are not fulfilling their volume indicators, since the recalculation of the rates is taken account of both in the plan and in the report.

The use of this indicator will make it possible to overcome the endeavor of enterprises to increase the amount of production to the detriment of the

quality of output and in this way will serve as an effective stimulus for accelerating technological progress. It will foster the maintenance of growth rates of the amount of production while there is a certain decrease in the quantity of output produced, but to the benefit of quality, which is very important for the shift to a universal improvement of the quality of output, from raw materials and materials to finished products. As a result, it will be possible to neutralize the influence of wholesale prices for new products when plan fulfillment is being evaluated. It will promote a systematic decrease in the wholesale prices per unit of useful effect, and will also improve the fulfillment of products list plans in favor of new equipment through the elimination of "advantageous" and "unadvantageous" products owing to different price levels.

With the introduction of the new indicator for determining the growth rates of the amount of production and evaluating the work of associations and enterprises with regard to the fulfillment of their deliveries commitments the branch gave up the use of the amount of sales of industrial output as the basic evaluative indicator of the work of its production elements. As the experience of using the amount of sales indicator had shown in the past, first, its level is influenced by factors which do not depend upon the enterprises and associations, and, secondly, it does not always ensure the accomplishment of the chief task which was posed when it was introduced -- an acceleration of the real turnover of assets in the economy. Thus, an enterprise which has been on time in producing and shipping output to a consumer may nevertheless be among those which have not fulfilled their sales plan as a result of lateness in processing documents at the bank or at the post office, an increase in the distance of deliveries which are stipulated by the state plan, or even on account of two work-free days coinciding with the end of the month. And, on the contrary, an enterprise which operates unrhythmically and has shipped output, for example, a day before the end of the quarter may nevertheless, bypassing the existing procedures, send a special messenger with payment documents to the consumer's bank, or demand the issuance of a letter of credit and receive money for the output which has been shipped late even before the expiration of the planning period. For this reason the indicator of the amount of sales will not be used at enterprises of the Ministry of Electrical Engineering Industry as an evaluative one, but will only be used as a calculation indicator. In addition, this will decrease the interest of enterprises in increasing wholesale prices and producing expensive output, since the sales indicator is influenced by these factors fully and directly, while the overstatement of a price for a new product on the basis of including in it an excess part of effect will have a much lesser influence on the indicator of the amount of production in comparable prices, if the part of effect which is deducted from the amount of the commodity output of the base year becomes smaller.

A determination of the growth rates of the amount of production by means of a recalculation of the commodity output of the base period by a coefficient which takes account of the effectiveness of new output compared to output being replaced demanded the performance of complex calculations for such coefficients for various groups of products. As has been shown above, the given coefficient reflects that share of the effect of a new product which should be deducted from the commodity output of the base year. But the relative effectiveness of different groups of products in the branch ranges from 20-30 percent to several hundreds and even thousands of percent. If under these conditions a single share of effect which is excluded from the amount of output from the base year is established for all products, then the newly recalculated increase in the amount of production for groups of products with an increased relative effect will be much larger than for products with a low effect. For the latter the amount of the deducted effect may prove to be so small that it will not compensate for a decrease in the real amount of production resulting from the increased labor intensiveness of production of new equipment. As a result, the production of certain groups of new products will be provided with excessive incentives, while the renewal of other products will remain unadvantageous.

If we were speaking about interchangeable products, there would be no problem; it is obvious that more effective products have to be more advantageous for producers. However, we are speaking about products (or rather groups of products) of different functions, and for this reason it is impossible to accept a greater advantageousness in the production of some and an unadvantageousness in the production of other types of new equipment which are needed by the economy. Differentiated coefficients were calculated for the (share) effect which is taken account of when the commodity output of the base year is recalculated. Consideration was given both to the relative effectiveness of new equipment for various groups of products and to the degree of the decrease in the production capabilities of enterprises as a result of an increase in labor intensiveness when new equipment is mastered.

In addition to the growth rates of the amount of commodity output determined with regard to the effectiveness of new products, the evaluative (fund-forming) indicators which are now being used in the branch include the proportion of highest quality category output in the total production of commodity output, an increase in labor productivity, and the fulfillment of output delivery commitments and assignments. These indicators (with the exception of the last) are directive. Besides them, the following are approved in the five-year plans (with a breakdown by years): Assignments for the production of the most important types of output in physical terms, the total amount of profits and of payments to the budget, the amount of capital investments and construction and installation work (with

a distinction made for those which are assigned for the reequipping and reconstruction of enterprises), the commissioning of fixed capital and production capacities, the amount of deliveries of material and technical resources (in the products list of the state plan) for supplying production, capital construction, and scientific research work, and also new equipment assignments. Among the latter, the following assignments are distinguished: for overall scientific and technical programs, for a rise in the technical and economic level of production and of the output produced, the mastery of new types of output, the introduction of new progressive standards, technological processes, production mechanization and automation equipment, and computer equipment, the economic effect from the performance of scientific and technical measures to raise the level of production, for an improvement of the organization of labor, and for an improvement of management.

The inclusion of the economic effect from the performance of scientific and technical measures among the directive indicators ties into a single whole the technical and economic planning and the planning of scientific and technological progress in the branch and its stimulation. The economic effect which is obtained as a result of a rise in the level of production, an improvement of the organization of labor, and an improvement of management is now approved in the five-year plans (with an annual break-down) and serves as the real basis which provides for a decrease in the cost of output, an increase in profits, and the fulfillment of all of the cost accounting indicators of enterprises. It represents the amount of the economy which has been obtained as a result of measures in the field of technological progress within each enterprise. The use of this indicator will make it possible to calculate an increase in profits on the basis of a decrease in costs and to introduce into the sphere of cost accounting relations the material interest of enterprises and associations in achieving an acceleration of the introduction of new equipment and also in reducing on this basis the materials intensiveness and labor intensiveness of output and achieving an increase in labor productivity. In addition, the indicator of the economic effect from the performance of scientific and technical measures serves as a basis for planning allotments to the economic stimulation funds for new equipment, and with regard to its influence on the fund-forming indicators, for planning the cost accounting stimulation funds. In this way the basic goal of the introduction of the new conditions is attained -- a unification of the planning and stimulation of current production work and of scientific and technological progress.

Simultaneously with the five-year plan and in accordance with it, long-term economic norms will be established for the associations and enterprises of the Ministry of Electrical Engineering Industry. These include, first of all, norms for the profit allotments which are left at

the disposal of the branch: for carrying out expanded reproduction, developing science and technology, and for the economic stimulation and financing of other planned expenditures (in the share from profits); for the single scientific and technical development fund -- in percentages of the planned amount of commodity output; and for the economic stimulation funds (on the basis of the fund-forming indicators).

Settlements with the state budget with respect to profit allotments will be performed by the ministry in a centralized manner. The planned payments to the budget will be made directly by the branch's associations, enterprises, and organizations, regardless of their fulfillment of the profits plan, and the final amount of payments for the system as a whole will be regulated in such a way that the payments are guaranteed in full regardless of the work results of individual associations and enterprises. With this kind of procedure of distributing profits there is a greater responsibility and interest on the part of all of the elements of the ministry in increasing production efficiency and adopting more intense plans. Among the other stable norms there are: a norm for determining expenditures for scientific research, experimental designing, and technological work (in percentages of the total production of commodity output), and a norm for determining the wage fund in industrial production in percentages of total commodity output in comparable prices and in scientific work in percentages of the total expenditures for scientific research, experimental designing, and technological work.

In order to strengthen the stimulating role of wages in increasing production efficiency, the use of economies in the wage fund for the dissemination of progressive forms of payment for labor is being expanded. Up to 50 percent of an economy which has been unexpended in a given year will be assigned to the material incentives fund, while an overexpenditure is subject to reimbursement from the material incentives fund.

There will be an expanded use of long-term credit as a source of financing capital investments when there is an insufficiency of the branch's own capital. New incentive markups are being introduced in order to interest enterprises in improving output quality. For products which are being introduced they are established for the entire effective period of the State Token of Quality, while for previously mastered output when it is awarded the Token of Quality they are established in the amount of 3 percent of the wholesale price. In the event of repeated recertifications, the Token of Quality and the wholesale price incentive markups are retained. In order to economically stimulate scientific research institutes, designing bureaus, and enterprises during the first three years of the production of new products, 70 percent of the incentive markups are assigned to the bonus fund, while when there is a second awarding of the Token of Quality 35 percent is assigned. Wholesale price discounts

amounting to 10 percent are established for second quality category products which are subject to removal from production.

In order to increase the interest of associations and enterprises in using cheaper types of raw materials, materials, and substitutes and decreasing the overall materials intensiveness of output, as a result of which the wholesale prices for finished output decrease, it is stipulated that prices are to be determined with regard to preserving the amount of profits which was obtained from the sale of the previously produced (replaced) output, but not lower than the profitability norm. In addition to this, 40 percent of the cost of economized materials is also included in profits when price is calculated. When the amounts of production and labor productivity are determined before the end of the five-year plan (or before the general review of wholesale prices in the branch) the wholesale prices which had been adopted in the plan for the output being replaced are being used. The same procedure of price setting is applied to cases of a decrease in wholesale prices as a result of the use of more productive processing methods (without worsening quality indicators) and with the production of new and cheaper output which is equal to or better than the output being replaced in its technical and economic parameters and quality.

The shift to the new conditions of planning and economic stimulation require the solution of serious methodological problems connected with determining the methods of calculating the new indicators, developing economic norms and providing them with stability and equal intensity, and validating effective quantitative mechanisms of stimulation. Mathematical economic methods and models find a wide use here.

As an example, let us examine the procedure for substantiating the scale for a decrease in the amounts of bonuses for the workers of the all-union industrial associations when there is a failure to fulfill the profits plan without regard to the incentive markups. As has been pointed out, the new procedure of planning and economic stimulation in the branch provides for an extensive introduction of cost accounting relations. One of the forms of the cost accounting relations in the all-union industrial associations is the introduction of material stimulation and material liability for workers for the fulfillment of planning indicators. In particular, it is planned to pay bonuses for the fulfillment of the basic indicators of the all-union production association (the growth rate of commodity output in comparable prices, an increase in labor productivity, and an increase in the production of highest quality category output), and also to reduce the amounts of bonuses when there is a failure to fulfill the profits plan without regard to the wholesale incentive markups for highest quality category products. The basic purpose of this regulation of bonuses is to place obstacles in the way of an above-plan increase in the cost of output and the covering of this increase with the additional profits obtained as a result of production of highest quality category

output. At the same time the decrease in bonuses must not be too excessive, since when the plan is fulfilled for the basic indicators the actual level of profits will be higher than the planned level and, for this reason, there are sources for bonuses and grounds for rewarding a collective.

The mathematical economic apparatus of the functions of incentives was used in developing the scale.* The task was set at developing a scale which provided for: a decrease in bonuses of up to 30 percent with the greatest possible underfulfillment of the profits plan without regard to the incentives markups; the establishment of a limit on the average amount of the decrease in bonuses at the level of 12 to 13 percent of the bonuses paid for the basic indicators; and an accelerated decrease in bonuses in measure with an increase in the amounts of plan underfulfillment.

A function which satisfies these conditions was found on a basis of an analysis of the fulfillment of the profits plan by the all-union industrial associations of the branch during 1978-1979. It has the form $Y = 3.75 \cdot X^{1.5}$, where

Y -- is the decrease in bonuses (in percentages of those paid for the basic indicators);

X -- is the percentage of plan underfulfillment.

Since the degree indicator exceeds 1, the curve of the function is concave, and this means that the demand for an accelerated decrease in bonuses in connection with an increase in plan underfulfillment has been met.

The decreasing bonus scale which is based on calculations is cited in Table 2.

The procedure in using the above scale is as follows. Let us assume that the profits plan without regard to the incentive markups has been fulfilled by 97.6 percent, that is, the underfulfillment is 2.4 percent, while the plan for its basic indicators has been fulfilled by an industrial association. In this case the amount of the bonuses paid for the fulfillment of the basic indicators has to be decreased as follows: for the attainment of the lower limit of the interval of underfulfillment -- by 11 percent, and for exceeding it -- by .6 through .9 percent for every .1 percent of underfulfillment, or by $.9 \cdot 6 = 5.4$ percent, and in all by $11 \text{ plus } 5.4 = 16.4$ percent.

* V. Khaykin, "The Plan and Material Stimulation," Moscow, "EKONOMIKA," 1970, Chapter 6.

An analysis of the scale shows, first, that it ensures an acceleratingly increasing amount of bonus decreases when there is an increase in underfulfillment (this can be seen from the fact that the second norm increases from interval to interval); secondly, the procedure for using it is simple and it is not necessary to employ complex mathematical calculations here; thirdly, the scale does not permit advantages at the transitions from one interval of effectiveness to another, since the depression at the limits of the intervals is the same when calculated for the upper and for the lower intervals; finally, fourthly, the average amount of bonus decreases in the scale comes to 13 percent, which fits within the established limits of 12-13 percent.

Table 2.

Percentage of Profits Plan Underfulfillment without regard to incentive markups	Percentage of decrease in bonuses paid for fulfillment of basic indicators	
	With the lower limit of the interval reached	Additionally for each .1 percent above the lower limit of the interval
0 - 1	--	0.4
1 - 2	4	0.7
2 - 3	11	0.9
More than 3	20	1.0*

*but not more than 30 percent.

The devices and methods of mathematical modeling are also widely used in the other economic planning calculations to substantiate the new procedure of planning and economic stimulation in the branch. They have been used in the calculations of wholesale price incentive markup scales for highest quality category products, in developing coefficients for recalculating comparable commodity output, in substantiating methods of cost accounting stimulation, and so forth. This has ensured a high effectiveness and an increased scientific level for the decisions which are made.

The shift by the branch to the new system of planning and economic stimulation is directed toward strengthening the role of the five-year plan, and making better use of the possibilities for accelerating scientific and technological progress and improving output quality so as to more fully satisfy the economy's needs for output while achieving an overall increase in production efficiency. This corresponds to the demands put forward by the 25th Party Congress and the decree of the CC CPSU and USSR Council of Ministers on improving the economic mechanism.

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NET OUTPUT, PRICE FORMATION DISCUSSED

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[Article by A. Komin, Deputy Chairman of the USSR State Committee for Prices, Doctor of Economic Sciences: "Net Output and Price Formation"]

[Text] The decree of the CC CPSU and USSR Council of Ministers "On Improving Planning and Strengthening the Influence of the Economic Mechanism on Increasing Production Efficiency and Improving the Quality of Work" provides for the approval by industrial ministries, associations, and enterprises in their economic and social development plans of a new production indicator -- an increase in net output (normed), and in individual branches -- of commodity output in comparable prices. The new indicator is designed above all for the determination of the amounts, dynamics, and growth rates of production for which purpose use was previously made of the indicators of gross, commodity, and sold output calculated on the basis of constant or operating prices.

It is known that all of the above value indicators have one basic defect: their formation is determined not only by the actual expenditures of live labor at a given production sector, but also by expenditures of past labor. In addition, at the final stages of the production of output the proportion of past labor expenditures is quite high. For example, in such processing branches of industry as machine building wages plus allotments for social insurance come to only 24.5 percent of the cost of output, in light industry -- 8.5 percent, and in the food industry -- 6.7 percent.

It is natural that the influence of past labor on the volume indicators creates an interest in mastering and expanding the production of materials intensive output. But whereas in the past this shortcoming did not manifest itself so tangibly, since the dimensions of the economy were much smaller and interbranch relations were not so complex and multilevel as they are now, under present conditions the struggle for an economy of fuel, raw materials, and materials in solving the problem of increasing efficiency is taking on paramount importance. It is this which explains the adoption of the new indicator for the measurement of production volumes.

The indicator of the amount of net output (normed) is, as it were, neutral with regard to the material expenditures for production and is therefore free of the above defect. An increase in labor productivity, the wage fund, and other economic indicators which are directly connected with the cost accounting work of associations and enterprises will be determined on the basis of this indicator.

In its economic content the indicator of normed net output is newly created value. But it reflects only that part of it which is represented in the wholesale price of an enterprise in the form of wages, allotments for social insurance, and profits, without including such forms of net income as rent and the turnover tax.

This indicator corresponds more closely to the newly created value at each association and enterprise and, consequently, to the principle of orienting production toward final results. Whereas an increase in gross, commodity, and sold output does not always signify an increase in national income, since it can occur on the basis of more materials intensive output with correspondingly higher prices, an increase in the amount of normed net output always leads to an increase in national income.

The question arises: Why has the indicator of normed net output and not the indicator of net output been adopted for measuring the amount of production? The net output indicator is obtained by means of subtracting all material expenditures and depreciation from the amount of commodity output in operating prices. It is quite simple and convenient for computation and does not require the introduction of a system of special norms. However, its shortcoming consists in the fact that net output can only be computed on the basis of current prices, since expenditures are taken account of in the prices actually being used and the problem of the comparability of this indicator arises. In addition, its magnitude is influenced by a change in material expenditures both on the basis of direct economies and on the basis of cheaper raw materials and materials. The latter is a positive factor, but it is already reflected in such an important indicator which characterizes production efficiency as profits.

From this point of view the normed net output indicator is more stable. It characterizes the amounts, dynamics, and growth of production more objectively, although it also is not free of the shortcomings which characterize value indicators. Thus, the problem of the differing advantages of producing products which differ in their profitability levels remains when it is used also. This indicator will be calculated by means of adding to wages and allotments the profits which are planned in the price for a given product. In accordance with the new regulations,

profits in the prices for output in the processing branches will be established in proportion to costs minus the expenditures for fuel, energy, raw materials, materials, and component products. In addition, of course, consideration must be given to the necessity for ensuring price correlations for interchangeable and analogous output, to economic efficiency, to the stimulating role of prices, and so forth.

In a word, profits in the net output norm will not be directly proportional to the wages which are calculated in it, which is a result not only of the above-mentioned characteristics of the formation of this indicator, but also of the inevitability of changes after its establishment in the wage expenditures themselves for the production of a given type of output as a result of an increase in labor productivity. The problem of differing advantages in this case is also exacerbated, since the proportion of profits in the norm will be substantially larger than in the price.

Given the differing advantages of production, the influence of products list and assortment factors on the fulfillment of volume indicators is preserved when the net output norm is used. It may even become stronger. This has to be kept in mind considering the important role of the new indicator in the evaluation of labor productivity and the formation of the wage fund. The influence of assortment changes on the amount of net output (normed) will probably have to be given special consideration.

True, with the use of net output (normed) new aspects appear in the problem of differing advantages. Whereas with the use of commodity or sold output difference in advantages depended not only upon the profitability of production, but also upon the materials intensiveness of output, with the new indicator the factor of materials intensiveness completely loses its significance, which is very important. Enterprises will not be interested in the production of "expensive" materials intensive output. From this point of view the normed net output indicator has an essential advantage compared to the value indicators being used.

The problem of stimulating technological progress and improving the quality of output is, as is known, complex and many-sided and it can only be successfully solved on the basis of an overall use of all economic levers and the entire economic mechanism (the plan, cost accounting, prices, finance, and economic stimulation). For this reason the introduction of the new indicator alone does not in and of itself make an important contribution to the solution of this important problem; however, it produces definite positive features.

First of all, it should be noted that through the action of such value indicators as gross, commodity, and sold output the creation of new types of output became adapted as it were to their demands. Sufficient

attention was not given to reducing the cost of new equipment on the basis of an economy of metal and other materials and of the use of cheaper types of raw materials and materials. This is why the 12 July 1979 decree of the CC CPSU and USSR Council of Ministers "On Improving Planning and Strengthening the Influence of the Economic Mechanism On Increasing Production Efficiency and Improving the Quality of Work" has provided that the wholesale prices for new products with a smaller materials intensiveness have to be established with regard to maintaining the amount of profits which were received from the sale of the previously produced (replaced) output, but no lower than the profitability norm. In addition, in order to determine the amounts of production and labor productivity until the end of the five-year plan the wholesale prices will be used which have been adopted in the plan for the output being replaced, which should promote a reduction in the cost of new equipment on the basis of decreased material expenditures. Since the normed net output indicator is not connected with material expenditures, they will not influence a rise in the cost of new equipment on the basis of material expenditures.

Note should also be taken of the fuller consideration of expenditures of live labor for the production of new equipment (we are not speaking about mastery expenditures which will be compensated on the basis of the single scientific and technical development fund). Frequently the creation of new equipment is connected with an increase in labor expenditures. However, in view of its increased efficiency and also of a possible decrease in material expenditures as a whole, the expenditures per unit of useful effect will decrease. The use of net output norms will make it possible to take fuller account of this special characteristic in the expenditures of live labor for the production of new equipment. When an experiment on the use of the normed net output indicator was conducted certain economists expressed doubts regarding the possibility of its having a positive influence on production specialization and cooperation. The opinion was expressed that since the net output norm would be formed on the basis of wages (expenditures of live labor), the endeavor might arise at enterprises to produce everything for themselves by themselves and to compensate for any high expenditures on the basis of the corresponding norms. However, in our view, this will not occur. First of all, the net output norms have to be established on the basis of branch, and not of individual expenditures. Secondly, they remain stable throughout the course of the five-year plan. Under these conditions associations and enterprises will be interested in increasing the amount of net output (normed) on the basis of a deepening of specialization and cooperation also, if this leads to a decrease in labor expenditures.

Special attention should be given in the first stages of introduction to the influence of the indicator of the amount of net output (normed) on the

wage funds of associations and enterprises. It cannot be permitted for an increase in this indicator on the basis of unenvisaged changes in products list and assortment to lead to an unwarranted increase in the wage funds. The latter must occur only in keeping with the growth rates of labor productivity which are stipulated by the plan. The coordination of these two indicators demands very careful control so as to prevent an overexpenditure of the wage fund.

The introduction of the new normed net output indicator will undoubtedly be connected with certain difficulties, since it will be necessary to perform a large amount of methodological and organizational work. The question arises: In which branches should this indicator be used? First of all, in order to characterize production volumes in the branches of the processing industry where the formation of value indicators (gross, commodity output) is greatly influenced by expenditures of past labor; and then in branches with large fluctuations in the proportions of material expenditures for the production of individual types of output, that is, in those places where there are reserves for reducing materials intensiveness (for example, in machine building).

In introducing the normed net output indicator it would be desirable to ensure its use in an entire branch or sub-branch as a whole, which will make it possible to use it more effectively in planned management at all levels. This will greatly facilitate the task of coordinating the norms for the formation of the economic stimulation funds in a ministry, association, and enterprise.

The most important issue in introducing the new indicator into the practice of economic management is the development of net output norms. They should be approved by the price setting agencies at the same time that prices for the corresponding types of output are approved. For output whose prices are approved in accordance with the existing procedure by ministries and associations (enterprises), the net output norms will also be approved by them. The present time when a general review of wholesale prices and rates in industry is being carried out is the most convenient moment for the simultaneous creation of net output norms.

To date, in the experimental use of this indicator, ministries have approved individual net output norms (for associations, enterprises). However, at the present time, when the experiment in individual ministries has moved to the stage of its practical introduction into the economy, it is no longer possible to be oriented by a system of individual norms. And not because it is difficult to approve them for each individual association or enterprise. In such a case they simply would not fulfill their economic role, since, first of all, individual norms do not ensure

the necessary economic comparability of the summary generalizing indicators of net output, and, secondly, it would be necessary to adapt all of the other economic norms to the individual expenditures of enterprises. The economic connection between prices and the net output norms would be lost. This is why the extensive introduction of these indicators into the economy makes it essential for them to be branch indicators and, like prices, based on branch expenditures.

The procedure for substantiating and approving the net output norms should be simple and accessible and adapted to the procedure of executing the documentation which is already functioning in the field of price setting; it should not require superfluous additional materials. It is with regard to this principle that Gosplan USSR, the USSR State Committee for Prices, the USSR Ministry of Finance, and the USSR State Committee for Labor have approved and coordinated with the USSR Central Statistical Administration the Methodological Instruction on the Procedure for Developing the Net Output (Normed) Indicator and Employing it in Planning.

The development of the net output norms will be carried out on the basis of the same calculations which are presented for the approval of wholesale prices. However, it is known that the basic indicator of the norm -- wages -- is presented in the cost calculations only for the basic and additional wages of production workers plus the social insurance allotments. The wages of the remaining industrial production personnel are not distinguished separately, but go under the heading of overhead expenditures (general shop, general plant). Sometimes they reach 50 and more percent of the wages of production workers.

The problem of taking account of total wages in the calculation is being solved by estimation with the help of special coefficients. The latter are defined as the relationship of the wages of an association's (enterprise's) service and management industrial production personnel to the wages of production workers.

Thus, along with the usual output cost calculation, only three indicators are presented for the approval of the net output norms of an association (enterprise):

The Wage Fund (Basic and Additional) of Industrial Production Personnel;

The Wage Fund (Basic and Additional) of Production Workers;

The Coefficient.

Under these conditions, the price setting agencies make additional demands upon the workers of associations, ministries, and departments. This involves greater attention to a substantiation of the wage expenditures for production workers, even in the event that their proportion in the cost of output is negligible. It is necessary for the substantiation of the wages expenditures to be performed in keeping with the labor expenditure norms for the production of output.

Another important element of the net output norm is profits. As has already been noted, the same profits which are calculated in the substantiation and establishment of prices are included in the norm. In this way the net output norm is built on uniform methodological foundations and is a part of the enterprise's wholesale price. The profits which are subject to inclusion in the price and the net output norm have to be calculated in keeping with the profitability norms which have been approved for the output price lists (groups) in relation to costs minus direct material expenditures (fuel, energy, raw materials, materials, and component products), and also in accordance with the other methodological principles of the establishment of prices for a given type of output.

In deciding in principle on the question of the necessity for establishing branch net output norms, note should be taken of one of the characteristics of their formation. It consists in the fact that in averaging the live labor expenditures for the production of a given type of output the conditions of production, and above all of cooperation, are also seemingly averaged out. With the same costs and with a single price for a final product its production may be cooperated at different enterprises in different degrees. At enterprises with a high degree of cooperation their own expenditures will be lower, while their material expenditures, including purchased semi-finished products, will be higher than at enterprises with a lesser degree of cooperation. At the same time, the cost of the production of output at both types of enterprises may not differ essentially. With a single price for a given product it becomes necessary to differentiate the net output norms for individual enterprises or groups of enterprise in relation to the labor expenditures connected with different cooperation conditions which are stipulated in the plans.

Thus, the differentiation of the net output norms has to be determined by objective factors and performed within the limits of the established average branch norms. It will be performed by the price setting agencies upon the presentation of ministries. The necessity for differentiating the net output norms also occurs during the course of their use if after their approval there has been an important change in the conditions of cooperation in individual production associations (enterprises).

The importance of the forthcoming work to approve net output norms cannot be overestimated. Not only the introduction of the new indicator into the practice of economic management depends upon its timely and high quality performance, but also the consequences of its employment and use. For this reason, the problem of the economic substantiation of the net output norms is coming to the forefront. The reliability of the materials which are presented for their substantiation is of great importance in the solution of this problem. The leaders of associations and enterprises and the workers of our economic planning services and administrations bear full responsibility for the quality of the materials which are presented for the substantiation of the net output norms, for the correctness of the approval of the norms which are established by production associations (enterprises) within the limits of the rights given to them in approving prices, and also for the correctness of their use.

In accordance with the procedure in effect, associations and enterprises approve: the wholesale prices for semi-finished goods, parts, models, stamps, and special tools and accessories which are produced for single orders for other production enterprises and organizations, and also for individual examples and parties of products and materials which are produced experimentally; and for capital repairs on the fixed capital of enterprises and individual copies of equipment and instruments, accessories, and spare parts for their own needs, and certain other types of output and services. For these types of output and services of an industrial character the associations and enterprises will themselves approve the net output norms, but ministries have to control the work of their subordinate associations and enterprises in this area.

In view of the wide products list and small proportion and also of the instability of the output for which prices and rates are approved by associations and enterprises, it is not mandatory for a norm to be introduced for each type of this output. Group or consolidated norms can be used here. Thus, when there are technical difficulties in establishing concrete net output norms as a result of the large instability of the nomenclature of work of an industrial character and of other output in this group specific net output norms may be determined in the form of stable normative coefficients which characterize for every enterprise the developed relationship of the amount of net output to the cost of the corresponding output in the wholesale prices of enterprises.

In addition to the approval of the appropriate norms at ministries, associations, and enterprises, a large amount of organizational work has to be performed in order to introduce the net output (normed) indicator into the practice of economic management. First of all, it is necessary

to study the possibilities and the conditions for the use of the net output (normed) indicator, its economic content, and the planning of accounting and reporting. There need to be careful preparations for its introduction and punctual approval. In addition, the necessary calculations have to be performed and the norms have to be coordinated with the indicators of labor productivity and the wage fund and with the norms for the formation of the economic stimulation funds.

The indicator of net output (normed) will not operate in isolation, but in the system of other evaluative value and physical indicators which characterize the work of associations and enterprises. Simultaneously with wholesale prices, a system of net output norms will be in operation in accordance with which the planned volume indicators of production will be formed. It is clear that under these conditions the economic role of wholesale prices and their influence on the work of enterprises will be somewhat decreased. True, they will continue to influence the economics of enterprises through such an important indicator as profits. However, part of the stimulating function of price will be taken up by the net output norm; this is why it is very important from the very beginning to establish economic control and to disclose the norm's positive and negative sides and its interaction with other indicators.

It is important for its use to have a positive influence on stimulating technological progress, improving the quality of output and improving the use of reserves to economize the material resources and, on this basis, on increasing production efficiency. The tasks which have been advanced by the decree of the CC CPSU and USSR Council of Ministers "On Improving and Strengthening the Influence of the Economic Mechanism On Increasing Production Efficiency and Improving the Quality of Work" require a creative and overall approach to their practical realization from all economic executives.

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2959

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PRODUCTION ANALYSIS USING NET OUTPUT NORMS

Moscow PLANOVOYE KHOZYAYSTVO in Russian No 12, Dec 79 pp 27-33

[Article by V. Paliy, Doctor of Economic Sciences, Professor: "Production Analysis on the Basis of Net Production Norms"]

[Text] The Decree of the CPSU Central Committee and the USSR Council of Ministers "On the Improvement of Planning and the Strengthening of the Influence of the Economic Mechanism on the Increase of Production Efficiency and Work Quality" provides for measures to perfect the planning of the volume of production and the productivity of labor in industrial enterprises and in production associations. Summary indicators of production output are planned and assessed in accordance with net production norms, and in some sectors in accordance with commodity production.

For the assessment of the fulfillment of obligations with regard to production deliveries, the volume of production sold is confirmed in the annual plans. This indicator continues to maintain its paramount significance in financial planning and in the mechanism of cost accounting. In enterprises for whom the growth of production in terms of net output norms is confirmed, the indicator of commodity production is determined by estimate. In statistical calculations and in reporting, an index of gross production is also maintained, which in many sectors of industry is identical with the magnitude of commodity production.

Under these conditions, the economic analysis of the indices of production output assumes growing importance for the correct and comprehensive assessment of the economic activity of industrial enterprises and production associations. Of special interest is the methodology of analyzing production on the basis of net production norms.

The index of net production, more fully than other cost indicators, meets the requirements made with regard to measures of the volume of industrial production and the productivity of labor, since it excludes the influence of the cost the required means of production on the volume of production, eliminating their repeated calculation, and makes possible a more objec-

tive assessment of the result of the production activity of a concrete collective. Its application fully neutralizes the influence of material-intensiveness and to a significant extent weakens the influence of the differential profitability of articles in the determination of the products list of the production output. The index of net production norms, which has been introduced in many sectors of industry, is a more reliable and economically substantiated measure of production than the earlier used indices of fixed net production and processing cost norms.

However, shortcomings of the indicator of net production must also be taken into account. Reflecting the newly created cost, it reflects not the actual volume of production, but only a part of it. The use value of production is to a greater extent reflected in the volume of commodity production. Precisely it will be sold and directed toward the satisfaction of concrete needs of society and precisely it is the result of useful productive work for a given span of time. It is impossible to agree with those economists who assert that only net production shows the actual result of production, while gross and commodity production characterize not so much the results as the expenditures of production. The fact is that the expenditures for the means of production must be regarded as their preservation in a new natural form, which became possible only as the result of the production of output. Representing gross income of the economy, net output characterizes the volume of the production of newly created cost. The physical volume of production is measured by the indicator of commodity production, the calculation and estimate of which are of considerable interest for the characteristics of the volume of production of a cost accounting enterprise or a production association. Moreover, a comprehensive estimate of the volume of production is possible only on the basis of a system of indicators. This circumstance must without fail be taken into account in the methodology of the analysis of the production of industrial output.

For an assessment of the system of indicators it is exceedingly important to have a common accounting base for all indicators that go into it. Commodity production, net output norm, and output sold are characterized by the unity of the accounting base. Commodity production and output sold are determined in accordance with the wholesale prices of the enterprise. Net output norms are also calculated on the basis of wholesale prices, modified in an appropriate way. These norms are determined together with the wholesale prices.

The analysis of the system of indicators which are presented in Table 1 (figures are taken provisionally) makes it possible to give a complete description of the volume of production and the sale of output in various indicators; to reveal the reasons for the differences in the magnitude of reciprocal indicators, each of which throws light on the result of production activity; to determine the impact of changes in the structure of the output produced on the magnitude of the deviations from the plan in terms of individual indicators. The latter is of particularly great

significance since a change in the structure of the products list has a distorting influence on the estimate of the production volume by any of the production indicators being considered.

Table 1. CHARACTERISTICS OF PLAN FULFILLMENT BY PRODUCTION VOLUME ON THE BASIS OF A SYSTEM OF PRODUCTION INDICATORS (in thousands of rubles)

Indicator	According to Plan	Actual	Deviations from Plan	Percentage of Plan Fulfillment
Output Sold	4,932	5,462	+530	110.75
Changes in the Surpluses of Unsold Output	-12	-32	-20	
Commodity Production	4,920	5,420	+500	110.16
Norms of Material Expenditures in Wholesale				
Prices of Enterprise	2,879	3,175	+296	-
Net Output Norm	2,041	2,245	+204	109.99
Including:				
Standard Profit	636	747	+111	
Standard Wage Fund	1,405	1,498	+ 93	106.61

The correct assessment of plan fulfillment by volume of production presupposes the disclosure of structural changes in production and their influence on the cost indicators. To this end a methodological approach may be used which is established in the indicator of net output norms. In the decree we have mentioned it is set forth that in the wholesale price lists the net output norms are also determined, which eliminate material expenditures in the costs of individual kinds of output. Proceeding with the articulation of the wholesale price, we can distinguish in the composition of the net output norm the standards of profit and wages. From the general standard of wages, according to the data of the calculations for the determination of net output norms, one can isolate the basic wage of production workers in the production cost of the product. This wage fund reflects the labor-intensity of the output, determined according to the standard estimate of labor expenditures (in this case through the standard of wages) for every product. If the output of products in physical terms is designated as q , and the standard of wages in the wholesale price of the product as p , the standard wage fund for the entire production will be equal to $\sum_{i=1}^n qp_i$.

The index of the correlation of the standard wage fund for actual output of production to the standard wage fund for its planned output (J) shows the actual measure of the change in the physical volume of the production of output:

$$I = \frac{\sum_{i=1}^n q_i p}{\sum_{i=1}^n q_0 p} \quad (1)$$

Consequently, if the indicators of commodity production and net output norms deviate from the measure of the change in the physical volume of production, the exposed deviation can be indicative of changes in the structure of the production of output. The latter, by virtue of differences in materials-intensiveness and profitability of individual component parts (types of output) of the cost volume of production, led to the deviation of the cost indicators of output from the physical volume of production.

The expansion of the indicator of net output norms cited in Table 1 makes possible the easy determination of the index of the change of the physical volume of production. It is equal to (1498:1405) 1.0661. Proceeding from the data in Table 1, this makes it possible to obtain the following analytical conclusions concerning the estimate of plan fulfillment in terms of production volume. The volume of commodity production is 10.16 percent higher than the planned volume, while the volume of net output norms exceeds the planned magnitude only by 9.99 percent. As a result of the output of more materials-intensive production, the enterprise exceeded plan fulfillment by 0.17 points. The physical volume of production is overfulfilled by 6.61 percent. The production of more profitable products ensured the overfulfillment of the plan in terms of net output norms by 3.38 points. The same applies to the indicator of commodity production. In the determination of the influence of structural changes on the fulfillment of plans with regard to individual cost indicators of products, the latter are considered as distinctive complexes (cost volume of production), consisting of separate elements (products, services, operations).

Meanwhile differences in the relative materials-intensiveness, output-capital ratio, labor-intensiveness, profitability of the individual element of the summary indicator also exert an influence on the cost indicators of the production volume. Therefore, the structure of every such indicator must be considered, on the one hand, as the proportionate magnitude of the cost of individual products (operations, services) in the total magnitude of a given cost indicator, and, on the other, as the relative materials-intensiveness, labor-intensiveness, and so on, in the cost of every product. The expenditure of materials, fixed capital, labor, and the magnitude of profit appear in commensurable, qualitatively

similar indicators, for example, in percentages of 1 ruble of products cost. The wholesale price of output has a clearly expressed structure, which is being determined by the portions of material expenditures, wages, and profit per unit of measurement (i. e., for every ruble or kopeck of the wholesale price). Since every product, operation, and service has a different structure of its wholesale price or net output norm, the component elements of this structure, being included in the summary cost indicator of production, are sure to exert an influence on its level depending on the relative weight of the individual elements in the composition of the whole.

The transition to the estimate of the work of enterprises and associations on the basis of net output norms does not fully eliminate their aspiration to fulfill the aggregate volume of production by virtue of more advantageous types of production. Besides the structure of wholesale prices and norms for the determination of net production, in the selection of the products list, inevitably, actual changes in the profitability of individual products, deviations from the level of profitability established in the price in the determination of net output norms report themselves.

In the analysis of the influence of structural changes on the volume of production, not only the structure of the wholesale price must be taken into account but also the planned profitability of the individual products in a given year.

Any cost indicators of the volume of production are subjected to the distorting influence of structural changes in the composition of the elements being put together and the structure of wholesale prices or the norms of the calculation of production. Without the express elimination of structural changes, they cannot and must not be used for estimating the fulfillment of planned targets with regard to production volume and for the calculation of basic indicators of the efficiency of production (labor productivity, capital-output ratio, expenditures per 1 ruble of commodity production, and others).

The elimination of structural changes in the indicators of production volume must be widely and everywhere introduced into the practice of economic work. We already have such experience in the elimination of the influence of structural changes with regard to the range of products in the estimate of production cost of commodity production and profit from its sale. Thus, in the report on the primary cost of commodity production (accounting forms No 6 and 1-s) the planned primary cost is scaled to the actual commodity production (i. e., to the actual volume and assortment of commodity production turned out). In the report on the sale of production (accounting forms No 12 and 2-kv) the plan indicators are scaled to the actual volume and assortment of production sold. In the reports on the output of production (accounting forms No 8, 1-p), it is also required for a reliable estimate of plan fulfillment with regard to production volume to reflect the indicators of production sold, commodity production, gross

and net production with a correction for the influence of structural changes, to take into account in the estimate of plan fulfillment the deviation of the actual from the planned structure.

The transition to the estimate of production volume according to net output norms does not free us from the necessity of taking into account the correction for the actual structure of production, but allows us to obtain it in the simplest way--using for the calculations of the elimination of structural changes the indicator of the standard wage fund in wholesale prices of the output. It represents a sufficiently elementary component of the wholesale price to exclude the influence of its structure (along with the exclusion of the influence of assortment changes in the output itself). Indeed, the wholesale price of a product (4) is built on the basis of its production cost with the addition of the standard profit (π). In its turn, production cost is separated into three consolidated elements: materials (M), amortization (A), and wages (3). Thus, the wholesale price of an enterprise for any product consists of 4 standard components: $= M + A + 3 + \pi$, of which only one (wages) is taken into the calculation of the change in the physical volume of production. The remaining ones are eliminated.

The perfection of the estimate of plan fulfillment in terms of production volume on the basis of the indices of net output norms and the elimination of the influence of structural changes according to the index of physical production volume also create the possibility of the more precise determination of the indicators of production efficiency, the calculation of which is carried out on the basis of the cost volume of production. In the first place, this applies to indicators of labor productivity. Table 2 lists calculations of the elimination of the influence of structural changes in production on the level of labor productivity, using the index of physical production volume obtained in Table 1.

As we see, the indices of plan fulfillment with regard to labor productivity according to accounting data as well as commodity production and net output norms differ from the corresponding indicators which are estimated taking into account the influence of structural changes.

The elimination of structural changes on the basis of the index of physical production volume brings together the results of the estimate of the indicators of labor productivity, proceeding from the labor-intensiveness of production, independent of a change in the wholesale prices in the system of indicators of production volume. In our example (Table 2), the index of change of the average registered number of industrial production personnel is equal to $(1,210:1,190) = 1.0168$, and the index of the change in the physical volume of production (Table 1) is 1.0661. Hence the index of the change in labor productivity may be determined in the following way: $(1,0661:1.0168) = 1.0484$. It coincides with the plan fulfillment in regard to labor productivity, calculated by proceeding from the

data in Table 2 with regard to commodity net output norms, after elimination of the influence of the structural factor on these indicators.

Table 2. ELIMINATION OF THE INFLUENCE OF THE STRUCTURE OF PRODUCTION ON LABOR PRODUCTIVITY

Indicator	Plan Indicators	Actual		Plan Fulfillment With Regard to Labor Productivity, in Percent	
		According to Accounting	Volume of Production	According to Accounting Data	According to Data Scaled to Physical Volume of Production
Commodity Production, thousands of rubles	4,920	5,420	5,245	-	-
Net Output Norm, thousands of rubles	2,041	2,245	2,176	-	-
Avg. Registered No. of Industrial-Production Personnel, no. of people	1,190	1,210	1,210	-	-
Output of Commodity Production per Worker, in rubles	4,134	4,479	4,335	108.34	104.86
Output of Net Production Norm, in rubles	1,715	1,855	1,798	108.16	104.84

The index of labor productivity, calculated by the proposed method of the elimination of structural changes, by its nature is close to the real and labor indices of labor productivity. For natural units, it may be noted in the particular form:

$$I = \frac{\sum q_1}{\sum q_0} : \frac{\sum P_1}{\sum P_0}, \quad (2)$$

where $q_{1,0}$ is the output of products in physical terms actually and according to the plan correspondingly; $\pi_{1,0}$ is the average registered number of industrial-production personnel.

However, the real index of labor productivity can be calculated only for similar production. Heterogeneous production leads to production being summarized with the aid of wholesale prices that do not always afford the possibility of a correct estimate of plan fulfillment. The elimination of certain shortcomings of wholesale prices in the estimate of labor productivity is promoted by its measurement according to the method of the sums of time, developed and introduced by economists of the GDR. Using this method, they determine the volume of production not in money terms, but in units of working time. The index of labor productivity in the present case is equal to:

$$I = \frac{\sum q_1 t_0}{q_0 t_0} : \frac{\sum T_1}{\sum T_0}, \quad (3)$$

where t is the labor intensiveness of a unit of production in norm-hours; T is the total expenditures of time for industrial-production operations.

The total expenditures of time during the established duration of the work day and the work week can be expressed through the indices of the average registered number of industrial-production personnel. The index of labor productivity, taking into account the elimination of structural changes, in accordance with the method using net output norms, may be noted from Formula (3) in the following form:

$$I = \frac{\sum q_1 p}{\sum q_0 p} : \frac{\sum \pi_1}{\sum \pi_0}, \quad (4)$$

Comparing it with the index of labor productivity according to the sums of time, one cannot but note their great similarity. The difference lies in the fact that the first index is calculated according to the standard work time (t), and the second--according to the standard wage fund (P), isolated in the norms of net production. The elimination of structural changes with regard to the standard wage fund leads to the most accurate measurement of plan fulfillment in regard to labor productivity on the basis of the real-labor index. The inclusion of net output norms in the system of indicators of the estimate of the volume of production secures the conditions for the perfection of the methods of estimating the productivity of labor and other indicators of efficiency.

The methods of estimating plan fulfillment with regard to labor productivity on the basis of the indices of production volume being applied and proposed, conceal the possibility of the distortion of the results by virtue of the influence of structural changes. The problem is not entirely solved by the transition to the estimate of production according to net

output norms. However, it provides an instrument for the simple elimination of the structural factor and the construction of a precise index for estimating plan fulfillment with regard to labor productivity. In order to increase the accuracy of estimating plan fulfillment with regard to the volume of production and labor productivity, the indices of net output norms must be introduced into the system of accountability and a system for the recalculation of the indices of the production volume according to its physical volume must be legalized. An additional column in the reports on production and the reports on labor will not entail great difficulties, but the increase in the accuracy and reliability of the estimate of plan fulfillment will be conducive to the strengthening of cost accounting and the economic mechanism.

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8970

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ECONOMIC PERFORMANCE IN UZBEK SSR LAGGING

Tashkent *Ekonomika i Zhizn'* in Russian No 10, Oct 79 pp 8-11

[Article by V. Dubrovskiy, deputy chief of the consolidated section of the national-economic plan of Gosplan UzSSR, and A. Shulakova, chief specialist of the same section: "To Boost in a Planned Manner the Output of Fixed Production Capital"]

[Text] It is important to ensure the rational use of everything available to the national economy, to rely primarily on intensive growth factors and to introduce on a wider scale into production scientific-technical achievements and advanced experience.

From the decree of the CPSU Central Committee and the USSR Council of Ministers "On Improving Planning and Intensifying the Influence of the Economic Mechanism on Raising Efficiency of Production and Quality of Work."

Higher efficiency of public production in our time has become a decisive condition of the further development of the national economy. One of its most important factors is fuller rational use of fixed production capital. This was stated with new force in the recent decree of the CPSU Central Committee on further improving the economic mechanism and the tasks of party and state organs as well as in the decree of the CPSU Central Committee and the USSR Council of Ministers "On Improving Planning and Intensifying the Influence of the Economic Mechanism on Raising Efficiency of Production and Quality of Work."

In implementing the decisions of the 25th party congress and subsequent plenums of the CPSU Central Committee while being guided by the theses and conclusions set forth in the speeches of General Secretary of the CPSU Central Committee, Chairman of the Presidium of the USSR Supreme Soviet Comrade L.I. Brezhnev on questions of the party's economic policy, the workers of our republic under the guidance of party organizations achieved marked

successes in the development of the national economy and raising of production efficiency.

In the first three years of the 10th Five-Year Plan, Uzbekistan's industrial production increased by 16.6 percent. Moreover, the weight of each percent today compared to the Ninth Five-Year Plan exceeds the latter by a factor of 1.5. From year to year the share of industrial production in the gross social product has grown. Whereas in 1975 it amounted to 53.5 percent, today (according to preliminary estimates) it is rising to 54.6 percent.

Tremendous industrial production potential has been created in our republic. At the outset of 1979, the value of all capital in the republic amounted to 47 billion rubles, including industrial production capital--9.3 billion rubles. In the past three years of the 10th Five-Year Plan, more than 60 new large industrial enterprises were built and put in operation, while tens of existing industrial production facilities were modernized and re-equipped. Owing to this, industrial-production fixed capital increased in the amount of 2.6 billion rubles.

While striving for a high level of production efficiency, labor collectives implemented major measures relating to acceleration of scientific-technical progress. In the three years of the five-year plan, there were installed and put in operation 760 mechanized and automated flow lines, 580 sections and shops were comprehensively mechanized and automated, more than 2,000 advanced technological processes were introduced and about 800 new kinds of machines, equipment, apparatus and instruments were developed and made operational.

The technical level and quality of manufactured products was significantly raised. Hundreds of new items received the state Seal of Quality. The volume of products with the honored pentagon grew 2.7-fold compared to 1975.

Much has been done and is being done in industry for achieving a fuller load of existing equipment and for maximal use of fixed production capital for the purpose of boosting capital yield. Let us remember that this indicator is computed as a quotient from the division of products manufactured in a year by the average annual value of the fixed production capital. One may judge the importance of this indicator with the help of the following example: if you were to increase the yield of fixed production capital in Uzbekistan by even a single kopeck for each ruble of the capital, there could be obtained in the course of a year additional industrial products worth roughly 100 million rubles.

On the whole, yield on capital in the current five-year plan is almost 10 kopecks greater than the five-year plan's calculations provide. But inasmuch as its dynamics are determined by the level of yield on capital in a plan year with respect to the basis year, it cannot help but be noted that this level drops somewhat. Whereas in 1975, 169 kopecks of products were

produced for each ruble of fixed production capital, in 1976--166 kopecks, 1977--162 kopecks and 1978--151 kopecks.

Yield on capital decreased at enterprises located in Uzbekistan for 18 of 43 union ministries and departments and also at enterprises of 17 of the 43 union-republic and republic ministries. The biggest reduction of this indicator (of almost 23 percent) was allowed to happen at enterprises of the USSR Ministry of Instrument Making and some others.

Analysis of the annual reports of 20 ministries and departments of union-republic and republic subordination showed that in 1976 yield on capital compared to 1975 was lower at 207 of 539 enterprises. Among them there were 29 of the 56 enterprises of the UzSSR Ministry of Food Industry, 10 of the 50 enterprises of the Ministry of Construction Materials Industry and 4 of the 15 enterprises of the Ministry of Light Industry of the republic.

In 1977 and 1978, the lowering of yield on capital continued both at the aforesaid sectors of industry and especially at enterprises Uzplodoovoshchvinprom, the UzSSR Ministry of Local Industry and certain other ministries and departments. As a result, for the three years of the five-year plan, the national income was short an amount exceeding 700 million rubles.

How is such a situation to be explained? First of all by the fact that the average annual growth of fixed production capital stemming from capital construction is at a faster pace than the growth rate of industrial production. If you were to take, for example, industry subordinate to the Uzbek SSR Council of Ministers, you would find that in the first two years of the five-year plan, with an average annual production-capital growth in excess of 15 percent, industrial production increased only 9.5 percent.

In other words, the capital-labor ratio is growing faster than labor productivity. Within the Ministry of Food Industry, the capital-labor ratio increased 4.1 percent and labor productivity only 0.8 percent, within the Ministry of Construction Materials Industry, this gap is even larger--the capital-labor ratio grew by 15 percent and productivity only by 0.4 percent.

One of the chief reasons for this is that the structure of capital investment in industry does not correspond adequately as yet to the directives of the 25th party congress and the November (1978) Plenum of the CPSU Central Committee. Some ministries and departments of the republic aspire as before to invest funds in new construction instead of allocating the major share of capital investment for the reequipment and modernization of existing enterprises and for increasing the relative share of the active part of fixed production capital.

But here there are latent tremendous reserves for raising production efficiency. This is confirmed, for example, by the experience of the Uzbek SSR

Ministry of Furniture and Woodworking Industry, the share of capital owing to reequipment of production there amounted to almost 65 percent of all operational fixed capital. And the yield on capital immediately grew by 4.6 kopecks compared to the preceding year.

At the same time, within the Uzbek SSR Ministry of Local Industry, the share of capital introduced through reequipment amounted to only 2.3 percent and the relative share of their active portion dropped by 3.3 points; as a result, yield on capital was reduced by 13.7 kopecks. Approximately the same sort of situation occurred at the Ministry of Installation and Special Construction Work of the republic and at Uzplodoovoshchvinprom and other organizations.

But the problem, of course, is not that many new facilities are being opened but that their planned capacities are being put to use extremely slowly and equipment is not employed at full power for a long time. The analysis of technical-economic indicators of the operation of many enterprises indicates that here is an inexhaustible source of unused reserves. A multitude of facts attest to this. For example, in 1977 production capacities for the production of mineral fertilizers were used slightly more than 82 percent, for the production of enamelware--61.5 percent, for the bottling of mineral water--less than 60 percent and for the production of nonalcoholic drinks--slightly more than 34 percent.

In the same 1977, for a number of products there was a lower level of use of production capacities than that attained in 1976. This was particularly noticeable in the production of cotton fabrics, wall and roofing materials, leather footwear, nonalcoholic drinks and some other products.

In 1978, the situation continued to be as before. In light industry, capacities for the production of cotton thread were used only 75 percent and even less for fabrics; in the food industry, capacities for making beer were used less than 72 percent and for making nonalcoholic drinks less than 41 percent. A similar situation was to be found at enterprises of other sectors of the national economy.

As a result of incomplete loading of existing equipment there was an underproduction of mineral fertilizers in an amount exceeding 144 million rubles, cotton thread--in excess of 142 million rubles and cotton unbleached [surovyve] fabrics--almost 98 million rubles, various construction materials--more than 92 million rubles, fruit and vegetable canned products--in excess of 84 million rubles. Such instances could be continued. Machine and equipment load is measured with the shift coefficient, that is, the relation of the number of machine shifts worked to the total number of machines in a shop, at an enterprise, in an industry. If, for example, you take a shop with 100 operable machines with two-shift work, where the first shift uses 90 machines and the second only 60, then in accordance with the 150

machine-shifts worked, the shift coefficient for the shop is 1.5. It should be a minimum of 1.8, as only in this way is it possible to attain a higher yield on capital.

Unfortunately, practice proves that the shift coefficient is much lower for many industries. At enterprises of the USSR Ministry of Petroleum Industry it amounts to 1.27, at the USSR Ministry of Heavy Machine Building--1.14, at the UzSSR Ministry of Meat and Dairy Industry--1.13 and so on.

If you were to consider on the basis of materials of daily observation the operation of 45 machine-building enterprises, at some of them the shift coefficient on the day of observation would be even lower. at Chirchiksel'-mash Plant, it amounted to 1.19, at the Kokand Electrical Machine-Building Plant--1.0 and at Andizhanirmash--0.89.

Calculations show that boosting the operational shift coefficient of an enterprise to 2.0 (there where it is lower) would make it possible to increase production output by almost 40 percent.

Operational heads frequently explain the poor load of equipment by workforce shortage. At the same time, losses of worktime in the republic industry stemming from downtime, absenteeism and absences with the permission of the administration amounted in 1977 to hundreds of thousands of man-days. These losses are particularly high at enterprises of the construction-materials and cotton-ginning industries and of the ministries of construction and rural construction of Uzbekistan. Due to losses of worktime, the republic's industry underproduces products roughly to the tune of 130 million rubles.

Serious defects in organization of production and mismanagement are perhaps the chief reasons for such an abnormal occurrence as drawn-out startup of planned capacities with violation of all normative time periods of making planned capacities operational at many enterprises. In 1976, 92 of 100 new enterprises inspected by Gosplan UzSSR (according to existing norms) were supposed to have reached planned capacity. Actually, it was reached at only 22 enterprises. New production operations were particularly slow in becoming operational at facilities of the UzSSR Ministry of Light Industry where projected capacity was reached at only two of 15 enterprises. And at the Ministry of Food Industry not a single one of five new enterprises attained planned capacity.

During 1977-1978, the situation failed to improve, and the national economy as before underreceived products amounting to tens of millions of rubles. Had new production facilities operated at full load, attaining projected capacities on schedule, last year the republic could have increased the production of knitted overwear by 1.6 percent, cotton thread--by 3.0 percent, box-calf leather goods--by 17 percent, beer--by 30 percent and non-alcoholic drinks--by 56 percent.

Even in 1977, ministries and departments worked out measures to the end of the five-year plan for raising production efficiency. These provided in particular the accelerated startup of new capacities and learning their operation, boosting of the shift coefficient and full loading of equipment. Achievement of these measures made it possible for a number of industries to significantly increase yield on capital. Within the ministries of meat-dairy, food and woodworking industries of the republic, it increased primarily through the reduction of reequipment and modernization time of existing enterprises, better use of equipment and a higher shift coefficient.

But on the whole, the outlined measures are being poorly realized in Uzbekistan's industry, which slows down the full operation of projected capacities and results in underutilization of fixed capital and therefore in reduced yield on capital.

Higher efficiency of public production cannot be achieved in full measure without the economy of past labor embodied in raw and other materials and energy, machinery and equipment. Material outlays (including amortization) amount to more than half of the gross social product. And they will grow with further development and cooperation of production.

Effectiveness of use of material resources in industry is reflected in such an indicator as materials intensiveness. In recent years, it has increased somewhat, that is, outlays of raw materials, fuel, power and amortization per ruble of gross product are growing. As shown by an analysis of reporting data of the Uzbek SSR Central Statistical Administration, material outlays in 1977 amounted to 72.93 kopecks for each ruble of gross product, whereas in 1975 they were 0.4 kopeck smaller.

Material outlays are growing in electric power, in some sectors of the fuel and chemical industry, ferrous metallurgy and machine building, in many sectors of light and food industry, in construction-materials industry and in particular in the production of prefabricated concrete. On the whole, for republic industry, the relative overexpenditure of material assets in 1976 alone amounted to 31.5 million rubles.

One of the reasons for this lies in exceeding of norms of expenditure of raw and other materials, fuel and other resources in the process of industrial production. According to data of the UzSSR Central Statistical Administration, in nine months of last year there were overexpended about 4,000 tons of cement, more than 184,000 gigacalories of heat energy and many other material resources.

But the fact is that reduction of materials intensiveness exerts a direct influence on production cost, increases yield on capital and boosts national income. A one-percent reduction of material expenditures for the republic's material production as a whole is the equivalent of increasing this year's national income by 168 million rubles.

In conclusion, we would like to emphasize again that we have at our disposal truly inexhaustible reserves for raising efficiency of production and quality of all work. We must work well to the end of this five-year plan in order to make up for whatever lag may have taken place and fulfill everything outlined in the plans. Only in this way, if we obtain a maximal yield from each lathe, each machine, each unit and the highest output of production from each square meter of production area, can the targets of the 10th Five-Year Plan be successfully fulfilled. Only with such a condition can there be a solid foundation for the realization of the decree of the CPSU Central Committee and the USSR Council of Ministers "On Improving Planning and Intensifying the Influence of the Economic Mechanism on Raising Efficiency of Production and Quality of Work."

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